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VOL. 34. Ser. A. Part 11. pp. 321-352. NOVEMBER, 1946.

THE REVIEW OF APPLIED ENTOMOLOGY.

SERIES A: AGRICULTURAL.

ISSUED BY THE COMMONWEALTH
INSTITUTE OF ENTOMOLOGY.

LONDON:
COMMONWEALTH INSTITUTE OF ENTOMOLOGY,
41, QUEEN'S GATE, S.W.7.

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MARCOVITCH (S.) & STANLEY (W. W.). **The important Peach Insects in Tennessee.**—*Bull. Tenn. agric. Exp. Sta.* no. 195, 23 pp., 17 figs., 11 refs. Knoxville, Tenn., 1945.

Conotrachelus nenuphar, Hbst., *Cydia* (*Grapholitha*) *molesta*, Busck, *Aegeria* (*Sanninoidea*) *exitiosa*, Say, and *Quadraspidiotus* (*Aspidiotus*) *perniciosus*, Comst., are the most injurious insect pests of peach in Tennessee, while *Aegeria pictipes*, G. & R., *Eulecanium* (*Lecanium*) *nigrofasciatum*, Perg., and *Scolytus rugulosus*, Ratz., are of some importance. An account is given of investigations carried out since 1930 on the seasonal occurrence and control of the first two, followed by notes on the habits and control of the other and a table showing the complete programme of sprays to be applied to peach against pests and diseases.

Observations on *Conotrachelus nenuphar* in orchards of peach and plum showed that the overwintered, first- and second-generation adults were present from early April to mid-June, about 20th June to 31st August, and during September and October, respectively, and reached peaks in late April or early May, mid-July, and late September. The second generation is small and develops in very late peaches. Oviposition was first observed in plums on 16th April in 1930 and on 26th April in 1931 ; the eggs hatched in six days, and, in 1931, the larvae remained in the fruit for 18–20 days. Larvae that entered the soil on 2nd or 3rd August gave rise to adults between 15th and 29th September. The emergence of larvae from fallen immature peaches in various years began as early as 10th May, reached a peak during the last week of May and continued until late June. The durations of the immature stages at constant temperatures of 59, 68, 77 and 86°F. are shown in a table, the averages for total development being 114·3, 51·3, 36·1 and 38·1 days, respectively. A few eggs failed to hatch in 28 days at 53°F., but hatched in three days when transferred to 68°F. Larvae did not develop at 53°F., even when kept for as long as 156 days.

Investigations on control were directed to finding substitutes for lead arsenate, which is effective but injures the foliage of peach. Six applications at weekly intervals of sprays containing 1 lb. cryolite or barium fluosilicate per 50 U.S. gals. did not injure the foliage, in preliminary tests, and these substances were as effective in sprays as lead arsenate in field experiments in 1930, as was also a dust of 50 per cent. barium fluosilicate [*cf. R.A.E.*, A **19** 672], which was superior to one of 50 per cent. sodium fluosilicate. Barium fluosilicate, synthetic cryolite and sodium fluosilicate all caused foliage injury. In experiments in another orchard, barium fluosilicate was injurious as a spray, and not as a 5 per cent. dust, while synthetic cryolite caused no injury. Fluorine compounds gave good control in tests in 16 orchards in four counties in 1931 [*cf.* **21** 94]. In 1932, infestation in fruit sprayed three times with barium fluosilicate or cryolite with or without 1 per cent. summer oil reached only 5·9–6·5 per cent., whereas it was 12·7 per cent. on the other trees in the orchard, which received other sprays applied throughout the season by the grower ; the presence of the oil had no effect on control. Infestation by *Cydia molesta*, which was heavy, was not reduced by the fluorine compounds, and the promising results of the earlier experiments against it [**19** 672 ; **21** 94] were not confirmed by subsequent tests. The larvae of *C. molesta* appeared to be of importance in the spread of the brown rot fungus [*Sclerotinia fructicola*], since 30·7 per cent. of the ripe fruits were infested by both, 12·6 per cent. by the fungus alone, and 1·9 per cent. by the fungus and by *Conotrachelus*. In 1937, the skin of ripening fruit that had been sprayed three times with 1¼ lb. Dutox [72 per cent. barium fluosilicate and 8 per cent. sodium fluoaluminate] per 50 U.S. gals. was found to be scorched, and cracks appeared along the suture ; in addition, the underlying tissues at the tip of the fruit were often injured. Some injury was also apparent on fruits sprayed with cryolite, which were malformed at the tip end and slightly smaller than those treated with lead arsenate ; small sunken areas and cracks also occasionally appeared on the skin, and the latter condition was generally followed by severe attack by brown rot. The injury appeared to be accentuated by misty, rainy weather and varied with the fertiliser applied, being more apparent on trees treated with superphosphate and less on trees treated with sodium nitrate than on those that had received no artificial fertiliser. In tests on a few trees in 1940, cryolite applied once at sepal-fall or ten days later caused no noticeable injury. Aluminium oxide and calcium phosphate were of no value as safening agents for cryolite when tested in 1941.

The relation between fertilisers and the defoliation of peach trees sprayed with lead arsenate was investigated in 1930 on trees sprayed four times with 1 lb. lead arsenate, 3 lb. lime and 5 lb. flotation sulphur in 50 U.S. gals. water. No damage was apparent on 25th May, when two applications had been made, but the foliage of trees that had received fertilisers was darker in colour than that of trees that had not. Injury first appeared on 8th July and was conspicuous by 12th August. The foliage of trees that had received fertilisers was then green and in good condition, and the fruit not yet ripe, whereas the other sprayed trees were almost completely defoliated, and the fruit, which was already ripe, showed considerable sun-scald, owing to the absence of shade. By 28th August, the difference had become less noticeable, as the defoliated trees had developed new leaves. Some defoliation occurred late in the season on trees that had received fertilisers, but was not serious. Nitrogen appeared to be the only element in the fertilisers that was concerned in promoting growth, and arsenical injury is apparently most frequent where peach is grown on infertile soils that are poor in nitrogen.

The seasonal abundance of adults of *Cydia molesta* was determined in 1932 by means of traps baited with fermenting molasses and ethyl cinnamate suspended in the orchard between 10th May and 31st August. Populations were lowest at the beginning of May, and the ends of June, July and August, and highest about 10th June, in the first and third weeks of July, and the third week of August ; the largest number of moths was trapped about the third week in July. In 1934, infestation of the fruit at harvest was only 4·2–7·3 per cent. in an orchard bordered on two sides by strawberry fields ; this is associated with the fact that *Macrocentrus ancylivorus*, Rohw., the most important parasite of *C. molesta*, also attacks the strawberry leaf-roller [*Ancylis comptana*, Froel.].

SMITH (R. F.) & MICHELBACHER (A. E.). **Abundance of *Hypera punctata* (Fabr.) in 1945.**—*Pan-Pacif. Ent.* **21** no. 3 p. 118. San Francisco, Calif., 1945.

Larvae of *Hypera punctata*, F., became abundant on bur clover (*Medicago hispida*) in two counties in California in April 1945. They are usually held in check in California by a fungous disease [*cf. R.A.E.*, A **33** 241], but this was uncommon at the time, probably as a result of the dry, warm weather. Adults were numerous after the first week in May and, when the plants dried up about three weeks later, migrated to houses and gardens, where they became a nuisance.

During a similar outbreak in another county in 1944, considerable defoliation occurred on lucerne.

TATE (H. D.) & BARE (O. S.). **The European Corn Borer.**—*Ext. Circ. Neb. agric. Coll.* no. 1531, [4] pp., 3 figs. Lincoln, Neb., 1945

A popular account is given of the appearance, bionomics and control of *Pyrausta nubilalis*, Hb., which was found for the first time in Nebraska on maize in Lancaster County in 1944 ; it is also known to be present in several counties of Iowa and Missouri along the Missouri River and in eastern Kansas [*cf.* *R.A.E.*, A **34** 177].

Staples (E. G.). **British Honduras. Department of Agriculture. Annual Report for 1944.**—[12] pp. [Belize, 1945.]

It is stated in the course of this report [pp. 6–7] that the leaf-cutting ant, *Atta cephalotes*, L., is the most serious pest of crops in British Honduras and that it renders the growing of cassava, vegetables and yams difficult in some places. Partial control has been obtained by digging out the nests of these ants and pumping in Cyanogas calcium cyanide ; treatment with carbon bisulphide also gives good results.

Stoffels (E. H. J.). **Le quinquina.**—*Sér. tech. Inst. nat. Etude agron. Congo belge* no. 24a, 2nd edn., 57 pp., 10 pls., 9 figs., 57 refs. [Yangambi] 1945.

A section (pp. 21–25) of this bulletin contains information on the pests and diseases that attack *Cinchona* spp. in the Belgian Congo and includes a review of some of the results of work by P. C. Lefèvre on the bionomics and control of *Helopeltis orophila*, Ghesquière [*R.A.E.*, A **32** 417 ; **33** 36–38], which is the most injurious. The other pests recorded are *Deilephila nerii*, L., *Coccus hesperidum*, L., *Systates variabilis*, Hust., *Cyrtacanthacris* sp., *Lycidocoris* sp., thrips and *Tetranychus bimaculatus*, Harvey. Very brief notes on the habits and control of some of them are included.

Cawthron Institute, Nelson, New Zealand. Annual Report 1944–5.—31 pp. Nelson, N.Z. [1945.]

The section of this report dealing with fruit research (pp. 14–18) includes a note on the introduced parasites of the codling moth [*Cydia pomonella*, L.] in New Zealand [*cf.* *R.A.E.*, A **33** 269]. It is stated that *Mastrus* (*Aenoplex*) *carpocapsae*, Cushm., was reared in small numbers and liberated and that *Ephialtes caudatus*, Ratz., was not found in two orchards in which it had been liberated in 1943.

Two further sections are concerned with entomological work (pp. 24–26). Supplies of *Rhyssa persuasoria*, L., obtained in the insectary from logs infested by *Sirex noctilio*, F., were released against this pest in the districts of Canterbury, the Bay of Plenty and Nelson. The biological control of the diamond-back moth [*Plutella maculipennis*, Curt.] on crucifers was even more satisfactory in both islands than in the previous year [*cf.* *loc. cit.*], and the larval parasite [*Apanteles glomeratus*, L.] of the white butterfly [*Pieris rapae*, L.], established at Nelson [*cf.* **32** 78], was collected and distributed over a wider area. *A. glomeratus* and the pupal parasite [*Pteromalus puparum*, L.] together were effective in checking the butterfly, even though conditions were less favourable to them than usual. Burning stubble in spring was the best method tested of controlling the stem-borer [*Glyphipteryx achyloessa*, Meyr.] of cocksfoot [*Dactylis glomerata*]. Further liberations were made of the seed weevil [*Apion ulicis*, Forst.] that attacks gorse [*Ulex europaeus*], and inspections in the Awatere Valley, where *Chrysomela* (*Chrysolina*) *hyperici*, Forst., was liberated on St. John's wort [*Hypericum perforatum*] in 1944 [*cf.* **33** 269], showed that this weed had been severely attacked by the beetle, patches up to 80 square yards in area being destroyed. The beetles were numerous on plants on the margin of the depleted areas, and in certain cases had spread half a mile from the original point of liberation. *Vespa germanica*, F., was found in a beehive in the Hamilton district, and although it is unlikely to prove harmful, its presence in New Zealand indicates the danger of introducing insect pests in aeroplanes, army equipment or imports unless stringent measures are taken for inspection and control.

ANDREWARTHA (H. G.). **Cockchafer Grubs as Pests of Pastures in the South-east.**—*J. Dep. Agric. S. Aust.* **49** no. 1 pp. 11–16, 5 figs. Adelaide, 1945.

Severe damage has recently been caused to pastures in the south-east of South Australia, particularly in those consisting of subterranean clover [*Trifolium subterraneum*] and annual grasses, by Lamellicorn larvae, of which the commonest is *Aphodius howitti*, Hope. Notes are given on the bionomics of this Aphodiid and the way in which it denudes the pasture by feeding on stems and leaves [*cf. R.A.E.*, A **22** 447; **29** 547]. Recommended control measures [*cf.* **31** 264] comprise ploughing heavily infested areas, which may be used for a crop in the following August, when the larvae cease feeding, the maintenance of a good protective cover of grass or stubble during February and March, which discourages oviposition, and the use of poison bran baits. The larvae of various other Lamellicorns, the identity of which is uncertain, feed partly on the roots of the plants, though they also eat soil, and during 1944–45, as many as 20–40 were in some cases observed per sq. foot. As a result, the plants become stunted during winter and sometimes die off in spring. Infestation occurs in pastures having a good cover of clover and grass stubble, and there are some indications that it is favoured by this condition. If this is so, it complicates the problem of controlling *Aphodius*. A further pest of pastures is the Hepialid, *Oncopera fasciculata*, Wlk., the larvae of which are present from October to August, spend the day in deep burrows in the soil and come out at night to feed on the grass. They have been known to destroy perennial pastures almost completely, which may be one reason for the popularity of annual pastures in this region.

GADD (C. H.) & FONSEKA (W. T.). *Neoplectrus maculatus* **Ferrière—a Predator and Parasite of** *Natada nararia* **Mo. and other Nettlegrubs.**—*Ceylon J. Sci.* (B) **23** pt. 1 pp. 9–18, 1 pl., 1 fig., 6 refs. Colombo, 1945.

Limacodids, of which *Natada nararia*, Moore, is one of the most important, have declined in numbers on tea in Ceylon since 1928, when they were of major importance, and since no organised campaign has been conducted against them, it is thought that they are normally controlled by natural factors. In field studies in the Passara district on populations of *N. nararia*, the bionomics of which are briefly reviewed from the literature [*R.A.E.*, A **11** 314; **20** 496], four generations, which became progressively smaller, were observed between March 1942 and January 1943, and another small generation occurred between January and March 1943. Only 19 larvae were collected from 40 bushes during November and the first part of December 1942, and the population remained at this low level throughout 1943. No control measures were applied, but the Eulophid, *Neoplectrus maculatus*, Ferrière, the egg, larva and adult of which are briefly described, caused heavy mortality among the larvae, and laboratory studies were accordingly made to determine its importance in control.

Adult males and females kept in glass tubes and supplied with sweetened water survived for up to 128 and 141 days, respectively, and the average was about 67 days. Mating takes place shortly after emergence. The females kill some larvae by puncturing them with the ovipositor, which immobilises them, and feeding on the juices that exude, and this process and that of oviposition, during which the host larva is punctured but not immobilised, are described. Oviposition began 3–4 days after adult emergence, and the egg was deposited on the back or side of the host larva ; the female does not feed at the puncture made immediately prior to oviposition. The eggs hatched in 2–8 days. The larva fed externally on the lower surface of the host, which died within a few hours. When two or more eggs were laid on one host, they usually hatched normally, but only one larva completed its development. The parasite larvae became fully grown in 2–7 days, and pupated beneath the bodies of their hosts ; the adults emerged in 7–13 days. Unfertilised eggs produce males, and the ratio of males to females was 1 : 1·25 in the offspring of females caged with males. The largest number of eggs deposited per female by four individuals of various ages under observation was 110 in 40 days, and the highest mean rate per day was 3·2, although one female laid seven eggs in one day. The four females deposited a total of 308 eggs and in addition killed 96 larvae by feeding on them. Larvae 7–10 days old were preferred for food and those 19–22 days old for oviposition. Larvae over 30 days old were not attacked for either purpose. It was occasionally observed in the laboratory that a larva had been used both for oviposition and, probably later, for food. Eggs on such hosts hatched, but the parasite larvae did not complete their development.

When the flowers of various plants that are common in tea-growing areas were presented to adult parasites instead of sugar solution, only those of *Tephrosia candida* appeared suitable as a source of carbohydrate, and adults kept supplied with them survived for an average of 49 days. Adults allowed to feed on the honey dew secreted by *Coccus viridis*, Green, an occasional pest of tea, survived for an average of 57·4 days. Females allowed to feed only on larvae of *N. nararia* and those given water only usually died within about four days ; when both sugar solution and larvae were available, average survival was approximately the same as when sugar solution was the only source of nourishment (62 and 67 days, respectively). Nitrogenous food is therefore not necessary for survival, but it is thought that lack of it may result in a reduction in the number of eggs deposited.

N. maculatus is known also to parasitise larvae of *Artona catoxantha*, Hmps., in Java [**29** 79] and the adults feed on *Narosa conspersa*, Wlk., and *Parasa lepida*, Cram., in Ceylon. At least three generations can develop during the period occupied by one of *Natada nararia*, and in view of the rapid rate of reproduction of the parasite and the fact that it is of frequent occurrence, even where Limacodids are scarce, it is thought that it must be of considerable importance in control.

LAL (K. B.). **Insect Pests of stored Grain in the United Provinces and their Control.**—9 pp., 1 pl. Allahabad [Dep. Agric. U.P.], 1944.

Brief accounts are given of the appearance, bionomics and distribution of the more important insects that attack stored cereals and pulses in the United Provinces. These are *Trogoderma granarium*, Everts, and *Sitotroga cerealella*, Ol., chiefly in wheat, *Calandra* (*Sitophilus*) *oryzae*, L., *Rhizopertha dominica*, F., *Tribolium castaneum*, Hbst., and *Corcyra cephalonica*, Staint., in various cereals, and *Bruchus chinensis*, L., *B. affinis*, Froel., and *B. analis*, F., in pulses. Notes are given on the damage caused, the sources of infestation, and its prevention by the proper storage of grain that is initially in good condition. One of the methods suggested for destroying any insects that may be in crevices in a room that is to be used as a store is superheating by a charcoal furnace so as to raise the temperature to 150°F. Before being stored, grain should be thoroughly dried in thin layers in the sun for at least six hours. A shallow trench should be dug round the area on which the grain is spread to trap any insects that crawl from it in search of shade, and insects so caught should be destroyed. The common grain fumigants are not suitable for local use, except under expert supervision, but mercury vapour is of value [*cf.* *R.A.E.*, A **34** 296].

[Moritz-Romanova (Z. E.), Berezhkov (R. P.), Davuidov (P. N.).] **Мориц-Романова (З. Е.), Бережков (Р. П.), Давыдов (П. Н.). Pests and Diseases of the cultivated Plants of Western Siberia and their Control.** [*In Russian.*]—9½ × 6½ ins., 208 pp., illus. Novosibirsk, OGIZ, 1941. Price 5 *rub.* 60 *kop.*

This book, to which nine authors have contributed, deals largely with insects, but also contains information on rodents and on plant diseases. Following general accounts of the economic importance of phytophagous insects in western Siberia, the structure, metamorphosis and methods of reproduction of insects and mites and the types of injury due to them, separate sections are devoted to polyphagous insects and to more or less specific pests of cereals, both in the field and in store, pulses, cruciferous oil-producing plants, sugar-beet, vegetables and orchard and small fruits, with notes on the appearance, bionomics and control of the species concerned. Control measures in general, including the use of insect parasites, the various types of insecticides and apparatus for applying sprays and dusts are discussed in further sections, and tables are appended showing the seasonal occurrence of the pests and diseases of the various plants, the type of injury and measures of control.

Koronéos (J.). **Les insectes de l'olivier dans le Pélion.** [*In Greek and French, with an Appendix in English.*]—[3+]71[+2] pp., 14 pls. Athens, S. N. Taroussopoulos, 1939.

A list is given of upwards of 20 insects and a mite (*Eriophyes oleae*, Nal.) that attack olive in the region of Mt. Pelion, in Greece, with notes on the habits, appearance and local distribution and records of the parasites of some of them. The more important are *Dacus oleae*, Gmel., which was parasitised by *Eupelmus urozonus*, Dalm., *Eurytoma rosae*, Nees, and *Eulophus longulus*, Zett.; *Prays oleellus*, F., which was parasitised by *Ageniaspis fuscicollis*, Dalm., *Elasmus flabellatus*, Boy., *Apanteles xanthostigmus*, Hal., and an unidentified Eulophid; *Margaronia* (*Glyphodes*) *unionalis*, Hb.; the Scolytid, *Phloeotribus scarabaeoides*, Bern.; the Psyllid, *Euphyllura olivina*, Costa; and the Coccids, *Pollinia pollinii*, Costa, *Filippia* (*Philippia*) *oleae*, Costa, *Parlatoria oleae*, Colv., and *Saissetia oleae*, Bern., which was parasitised by *Scutellista cyanea*, Motsch. *Dacus oleae* is the most important, and observations are recorded from which the author concludes that it is itself indirectly responsible for invasion of the fruits by *Macrophoma dalmatica*, which causes them to rot so that any *Dacus* larvae in them die. He considers that this fungus is introduced into the fruits by the Cecidomyiid, *Lasioptera berlesiana*, Paoli, which oviposits in the oviposition punctures of *Dacus* and possibly occasionally in its emergence holes. The fungus and its Cecidomyiid vector almost always occur together, so that control of *Dacus* could best be achieved by increasing the numbers of *Lasioptera*.

The other insects recorded include a woolly Aphid, *Prociphilus oleae*, sp. n., which was found in several parts of Greece on the trunks and branches of olive and *Phillyrea media*. It is dealt with at greater length in the appendix, in which are given the characters of the only three forms observed. These comprised fundatrices, which occurred in fissures near the base of the trunks in March, winged migrants, which were found on shoots at the base of the trunks and occasionally higher on the trunk in April and May, and alate sexuparae, which were taken in flight and in cracks on the trunks of olive trees in November and December. The summer foodplant is unknown.

Ferrière (C.), Défago (G.) & Roos (K.). **Lutte contre le doryphore de 1923 à 1943.**—148 pp., 40 figs., 3 pp. refs. Berne, Verbandsdruckerei S.A. [1944.] (With a Summary in German.)

Descriptions are given of all stages and the life-history of *Leptinotarsa decemlineata*, Say, its spread on potato in Europe is summarised, and work on the susceptibility to it of varieties of potato and allied plants and on its control in various European countries by hand-collection, natural enemies and the use of insecticides is reviewed. Measures to prevent its spread to Switzerland were taken in 1923, the year after it was reported from France, and subsequently, but it was observed there in 1937 [*R.A.E.*, A **26** 70]. Its subsequent spread throughout that country [*cf.* **32** 179, etc.] is described up to 1943, when only one canton was still free from it, with details of the legal and administrative measures taken, the annual campaigns against it, and the expenses involved. The control measures chiefly adopted in the beginning were hand-collection by school children, spraying the foliage with lead arsenate against the adults and larvae, and injection of carbon bisulphide into the soil against the pupae [*cf.* **28** 586]. From 1939 onwards, laboratory and field tests were made of many other insecticides. Calcium arsenate was found to be effective as a foliage spray and harmless to the plants whether applied alone or with Bordeaux mixture, and it was officially recommended. Other effective materials included that later known as Gesarol [a preparation containing DDT], which gave excellent results in sprays and dusts in 1941 [*cf.* **31** 181] and 1942. More detailed experiments in 1943 showed that all the insecticides tested were more effective against younger larvae than against older ones, and that dusts were more effective than sprays against the latter. Both sprays and dusts of Gesarol were applied in field plots and proved effective against adults that migrated to the plants within the following week, as well as those that were on the plants at the time

West (T. F.) & Campbell (G. A.). **DDT, the synthetic Insecticide.**—8¾ × 5½ ins., xii+301 pp., 13 pls., 1 fig., many refs. London, Chapman & Hall, Ltd., 1946. Price 21*s*.

This is a review of the extensive literature on the nature and uses of DDT published up to the autumn of 1945 and is divided into two main parts. The first contains detailed accounts of the research in Switzerland that led to the discovery of the insecticidal properties of DDT, its chemistry and that of related compounds, methods of manufacturing it and applying it in dusts, aqueous suspensions, solutions, emulsions and aerosols, and experiments on its toxicity to man and warm-blooded animals when absorbed in different forms through the skin, by ingestion or by respiration. Investigations on the incorporation of DDT into paints, textiles and paper are described in detail, and tests on other aspects, such as its dispersal as a fog, its action on fish and its fungicidal and repellent effects, more briefly. In the second part, work in various countries on the use of DDT against Arthropods of medical and veterinary importance and insects and other pests of plants and stored products, and on its effect on beneficial insects and plants is reviewed in detail. A popular account of the development, manufacture and use of DDT during the late war is given in an introduction, and suggestions as to possible future developments in its use in a concluding section. A subject index and an index to the authors referred to are provided.

Baudyš (E.). *Agrilus derasofasciatus* **Lac. ve větvích** *Pistacia terebinthus* **L.** [*A. derasofasciatus* in Branches of *P. terebinthus*.]—*Acta Soc. ent. Bohem.* **37** no. 1–2 pp. 27–28. Prague, 1940.

Dying branches of *Pistacia terebinthus* in the district of Crkvenici, Jugoslavia, were found in 1925 to be infested by *Agrilus derasofasciatus*, Lac. This Buprestid is known to attack grape vines in France and Germany, but had not previously been recorded from *Pistacia*. It is a secondary pest, usually causing little injury, and larvae were taken from *Pistacia* that was already weakened by infestation by the mite, *Eriophyes pistaciae*, Nal., and the Aphid, *Pemphigus cornicularius*, Pass.

On grape vines, the eggs are laid on the branches and hatch in June ; the larvae bore into the wood, overwinter twice and pupate in their galleries in the spring of the third year. The population is greatly reduced by unfavourable weather at the time when the adults are pairing and during the hatching period. Good growing conditions and the removal and burning of infested branches are recommended for control.

NOVÁK (V.). **Nový nález mravence** *Monomorium pharaonis* **L. (Myrmicidae) v Praze.** [A fresh Occurrence of the Ant, *M. pharaonis*, in Prague.]—*Acta Soc. ent. Bohem.* **39** no. 2 pp. 135–136. Prague, 1942.

A severe outbreak of *Monomorium pharaonis*, L., occurred in the summer of 1942 in a block of flats in Prague that had been moderately infested for about two years. The nests of the ants were found in the basement associated with the boilers and furnaces used for central heating [*cf. R.A.E.*, A **31** 131], and the ants spread along the heating pipes throughout the building, being particularly numerous in a butcher's shop and the adjoining flats on the ground-floor. The use of a sweetened liquid bait in which the ants would drown was recommended.

STAMPFEL (J.). **Pokusy o výživě potemníků.** [Experiments on the Feeding of Tenebrionids.]—*Acta Soc. ent. Bohem.* **41** no. 1–4 pp. 4–12, 4 refs. Prague, 1944. (With a Summary in Latin.)

Tenebrionids are reared in large numbers in Czechoslovakia and Germany as food for fowls during the winter when insects are scarce. In experiments in Czechoslovakia in 1941–43, in which larvae and adults of *Tenebrio molitor*, L., and *T. obscurus*, F., were offered a variety of products as food, they showed a definite preference for potatoes, fed readily on bread products and meat, considerably less so on peas and beans, and not at all on sugar ; fats were consumed only by the very young larvae, and spices and tobacco leaves were avoided. The adults and in some cases the larger larvae attacked other individuals of their own species when insufficient moisture was provided.

LESNE (P.). **Quelques remarques sur le** *Rhizopertha dominica* **F. (Col. Bostrychidae).**—*Rev. franç. Ent.* **7** fasc. 4 pp. 145–151, 14 figs., 10 refs. Paris, 1941.

The author gives notes on the morphology of the newly hatched larva and the adults of *Rhizopertha dominica*, F. He considers that this Bostrychid is primarily a wood-borer and that its development in grain is only secondary, and records the discovery of two adults in a common gallery in a branch from French Guinea, many in dried cut reeds on the banks of the Zambesi and one inside a dead branch in Mozambique, where numbers were often observed flying above piles of cut wood at sunset.

LEPESME (P.). **Etude de la faune entomologique des denrées emmagasinées I. Cucujides.**—*Rev. franç. Ent.* **6** fasc. 2 pp. 58–73, 13 figs. Paris, 1939. **II. Ulomini (Col. Tenebrionidae).**—*Op. cit.* **8** fasc. 1 pp. 34–42, 10 figs. 1941.

In the first part of this series, the author gives notes on the appearance, distribution and habits of the ten species of Cucujids that infest stored products together with a key to the adults and information as to the products attacked In the second, he deals similarly, though more briefly, with 14 Tenebrionids of the tribe ULOMINI, giving keys to the species in some genera.

DUCASSE (G.). **Notes sur *Matsucoccus feytaudi* (Homopt. Coccid.).**—*Rev. franç. Ent.* **8** fasc. 4 pp. 217–225, 6 figs. Paris, 1941.

Descriptions are given of all stages of *Matsucoccus feytaudi*, sp. n., which was found infesting *Pinus pinaster* (*maritima*) in the Landes in 1935 and in that Department and the Gironde in 1938. It occurred in large numbers under the bark of the trunk and in the resinous swellings produced on it by *Dioryctria splendidella*, H.-S., and was especially abundant on the lower part of the trunk of large trees, but apparently causes little damage. Its bionomics were studied in the laboratory. Eggs are laid from January until May and hatch in about one month. Development lasts about a year, and the adult males and females are present from about 1st January until mid-April and May, respectively.

VAYSSIÈRE (P.) & LEPESME (P.). **Sur quelques Bruchides nuisibles (Col.).**—*Rev. franç. Ent.* **8** fasc. 4 pp. 198–202, 1 fig., 1 ref. Paris, 1941.

The authors give lists of indigenous and imported Bruchids found in stored pulses in France and indigenous ones found on pulses in the field, with notes on the seeds they infest. The imported species include one of the genus *Spermophagus*, which is described by the junior author from adults of both sexes as *S. dorsopictus*, sp. n. [*cf.* next abstract] ; living examples were found in dried beans from Madagascar.

PIC (M.). **Note rectificative (Col. Bruchidae).**—*Rev. franç. Ent.* **9** fasc. 3–4 p. 148 [*i.e.* p. 152]. Paris, 1943.

The author considers, from its description, that *Spermophagus dorsopictus*, Lepesme [see preceding abstract] is a synonym or variety of *S. subfasciatus*, Boh.

COCKBILL (G. F.), HENDERSON (V. E.), ROSS (D. M.) & STAPLEY (J. H.). **Wireworm Populations in relation to Crop Production. I. A large-scale Flotation Method for extracting Wireworms from Soil Samples and Results from a Survey of 600 Fields.**—*Ann. appl. Biol.* **32** no. 2 pp. 148–163, 4 figs., 6 refs. London, 1945.

The wireworm survey in the eastern counties of England during 1941–42 [*cf.* *R.A.E.*, A **31** 426, etc.] revealed many cases in which the damage due to wireworms did not correspond with the estimated field population. A possible explanation for this was the inaccuracy of counts made by picking wireworms out of the soil samples by hand, and tests showed that such methods recovered an extremely variable proportion, and, on the average, only 40 per cent. were detected. The washing and flotation technique developed by Salt & Hollick [**32** 306] was too slow in its original form for large-scale work, but proved very satisfactory when modified. Apparatus capable of treating ten soil samples (4 ins. in diameter and 6 ins. deep) together was used, and other changes were the abandonment of freezing before washing, the soil being broken up by stronger jets of water, and the substitution of brine (specific gravity 1·18) for the solution of magnesium sulphate and of kerosene for benzene. When properly used, this method was found capable of extracting at least 95 per cent. of the wireworms present in the soil samples.

The modified sampling technique was used to estimate the wireworm populations in about 600 grass and recently ploughed up arable fields in eastern England between December 1942 and May 1943, and the information thus obtained confirmed that obtained by Salt & Hollick [**32** 307]. The average population per acre was 2½ million larvae of all sizes and 1½ million larvae 5 mm. or more in length ; the highest recorded was 8,900,000 per acre on a marsh. The number of larvae 5 mm. or more in length was found to be between 1,025,000 and 2,000,000 per acre in about 50 per cent. of the grass fields and over 2,025,000 in more than half of the others, whereas it was estimated at less than 600,000 in 66–75 per cent. of the fields sampled by the hand-sorting method. No significant difference was found between the average populations on unploughed and recently ploughed grassland examined during January–May 1943, but there was a reduction of about 30 per cent. in drilled fields in which the first crop was in an early stage of growth. A reduction of more than 50 per cent. occurred during the first year of cropping, and some evidence was obtained that the rate of decline then decreased.

Little relation could be detected between soil type and size of population except that populations were low in black-fen and chalk soils, though only scanty data were available. Estimates based on the hand-sorting method had suggested that black-fen soils support large populations [*cf.* **31** 25], but this result is attributed to the ease with which the larvae can be detected in soils that break down readily and provide a black background. Populations on ten grass fields that formed a continuous area on soil of one type were found to vary from 750,000 to 3,350,000 per acre, and the different population levels were evenly distributed among the fields. As similar conditions were found in other areas, doubt is cast on the previously-held view of the existence of well-defined areas of high or low population. It was also shown that populations in Essex, which were hitherto thought to be low, are of the same order as elsewhere in eastern England.

The composition of populations in individual fields was studied between January and May 1943 and found to vary considerably. Histograms are given showing the distribution of size groups among populations in unploughed grass, in soil cultivated for the first crop, during the early growth of the first crop, and after the first and second crops. There was a decline in the number of wireworms less than 5 mm. long in the first year after ploughing, but this was apparently not continued during the second year. Inspection of the crop results for 1943 on fields of which the populations had been estimated by the washing method showed a much closer relation between populations and damage than had been obtained by the hand-sorting method in the previous year ; in particular, a positive correlation with rising populations was obtained in fields with medium populations, which comprised about 66 per cent. of the total, whereas the hand-sorting method had given a negative correlation. When damage to the different crops was considered separately, a very marked positive correlation was found in the case of winter and spring wheat, oats, barley and sugar-beet, and evidence was obtained that barley is less susceptible than other cereals ; the low susceptibility of linseed and flax [*cf.* **31** 426] and, to a less extent, of peas and beans [*cf.* **30** 455], was also apparent.

ROEBUCK (A.), BAKER (F. T.) & WHITE (J. H.). **Observations on the Biology and Experiments on Control of the Mangold Fly (*Pegomyia betae* Curtis) on Sugar Beet.**—*Ann. appl. Biol.* **32** no. 2 pp. 164–170, 2 figs., 12 refs. London, 1945.

In view of the recent increased damage by *Pegomyia hyoscyami* var. *betae*, Curt., to sugar-beet in Nottinghamshire, where losses of up to 40 per cent. of seedlings have been reported, investigations on its bionomics and control were made there in 1942–44 on about a square mile of land containing fields in which beet and cereals were being grown alternately. The results are compared with those of workers in continental Europe [*cf. R.A.E.*, A **20** 258 ; **21** 84 ; **22** 83, 211, etc.], where the fly has been a more important pest than in England. Observations of the dates of adult emergence from field-collected puparia showed that in 1943 adults of the overwintered generation emerged during the first half of April and again at the end of April and the beginning of May, those of the first generation during the second half of June and those of the second during the second week of August, though some puparia of this generation overwintered and gave rise to adults in the following April–May. It is presumably these overwintering puparia of the second generation that give rise to the early spring adults. Oviposition occurred in the field between 3rd and 29th May, 16th June and 10th July, and 12th and 19th August.

Counts were made at approximately two-day intervals between 11th May and 2nd June of the eggs deposited on beet seedlings by females of the overwintered generation. The first eggs were laid singly or in pairs on the cotyledons, but few of these hatched. Oviposition on the foliage leaves reached a maximum on 20th–21st May, and almost all the eggs hatched. The number of eggs laid per batch increased as the leaves grew. The average number per yard of drill row had reached 366 by the time the counts ended ; this gave an average of 8–9 per plant, but mortality of plants was slight. The larvae were observed to migrate to other leaves when they had exhausted the food-supply available in the first ; the maximum distance they can travel along the ground is about 4 ins. [**22** 211]. Pupation took place in the soil at a depth of 2–3 ins.

Experiments were carried out in 1943 on the control of adults of the overwintered generation in a wheat field in which beet had been heavily infested in the previous year. Emergence was abnormally early, and the treatment was begun on 3rd May, when a bait spray of 4 lb. sodium fluoride, 9 lb. beet molasses and 10 gals. water was applied to a belt round the margin of the field, where the adults were numerous, at a rate of 50 gals. per acre ; this rate gave more than adequate coverage and was later halved. The spray caused slight temporary discoloration but no damage to the plants. The adults readily took the bait, and three days later there were large numbers of dead insects, including many examples of *Pegomyia*, on the ground below the wheat, and some spray still remained on the plants. The field was treated again on 6th May with a spray in which the molasses was replaced by 3 lb. sugar ; the flies were not attracted to it, a white crystalline deposit appeared on the plants after ½ hour, and no evidence of any further mortality was obtained. The molasses spray was applied on 29th June and again on 6th July against the first-generation adults in a seedling beet field, but oviposition had begun before the first application was made and there was little ultimate difference between damage on treated and untreated plants, although many dead flies were observed two days after the treatment. The spray did not injure the plants.

Traps consisting of pieces of board, 6 ins. square, coated with an adhesive and supported on a central peg, were placed in the wheat field that had been sprayed early in May and an unsprayed barley field that had also contained infested beet in 1942 to provide a comparison of the populations. The traps were at ground level and at a height of 6 ins., but those at the latter height were ineffective. Up to 17th May, the flies were more numerous in the unsprayed field, although the wheat provided better cover. After that date, they were rather more numerous in the wheat, probably because the bait-spray had lost its effectiveness and the wheat gave better protection to the flies that emerged late.

In 1944, wheat was growing in the field sprayed against the first generation in 1943, and the molasses spray was applied at the rate of 30 gals. per acre to a strip round the headland and another farther in the field. Emergence began on 26th April and reached a peak on 18th May, and the spray was applied on 18th and again on 22nd May. A marked reduction in numbers of flies was noted from 26th May. Four days later, as many as 25 adults of a parasite of the genus *Opius* were taken per yard of drill row on the headland. Attack by larvae of the first generation on neighbouring beet was negligible on 16th June ; damage by the second generation was even less noticeable, and none was caused by the third.

Experience in previous years and observations in 1943 indicated that there was considerable loss of yield in crops sown in mid-April in years when infestation was heavy, but that infestation by the first generation was avoided if sowing was delayed until mid-May ; in 1943, such late-sown crops were not attacked to any extent by the later generations.

Parasites of the genus *Opius* emerged from the field-collected puparia ; the percentage parasitised was negligible in the first generation of 1943, but increased during the course of the work with each successive generation until it reached 95–100 per cent. in the second generation of 1944, and no puparia of the following generation could be found. This increase is attributed to a combination of natural factors and the reduction in numbers of the host by spraying, and this view is supported by the fact that attack by *Pegomyia* was negligible in the experimental area in the spring of 1945, though it was generally heavy elsewhere in central Nottinghamshire. It is suggested that puparia of the second and third generations should be collected regularly in Nottinghamshire to ascertain the rate of parasitism and date of emergence in spring, and so permit recommendations of safe sowing dates and correct spraying dates if spraying appears to be necessary.

PEARSON (E. O.) & MITCHELL (B. L.). **A Report on the Status and Control of Insect Pests of Cotton in the Lower River Districts of Nyasaland.**—[1 +] 48 pp., 7 pls., 22 refs. Zomba, Govt. Print., 1945.

Since about 1935, when Lake Nyasa renewed its discharge into the Shire River, floodland has not been available for the cultivation of cotton in the Lower River area of Nyasaland, and the crop has had to be grown in dry-land areas dependent on rainfall for moisture. Crop production has varied very widely, and a survey of the causes of the variation is given in this Report. It is shown that insect pests are responsible for most of the loss of crop that occurs, and that *Diparopsis castanea*, Hmps., is the most important of them [*cf.* *R.A.E.*, A **27** 125 ; **30** 85]. This bollworm, the bionomics of which are described, infests the crop from about March until it is uprooted at the end of October, and infestation by it has the effect of delaying the production of a crop until late in the season, when infestation by *Dysdercus* becomes serious. Pupae of the bollworm produced early in the season complete their development in a few weeks, but increasing proportions of those produced as the season advances from about mid-May onwards do not give rise to moths until the following year [*cf.* **28** 528 ; **31** 390 ; **33** 89, etc.], and it is the progeny of these moths that infest cotton in March.

Since the bollworm has no other food-plant in this area, there are two possible methods of control. The first would be to delay planting until at least the middle of February, so that the moths from the long-term pupae would die before food becomes available for their progeny, and the second, to plant the crop early and destroy it before the flush of fruiting that accompanies the August rise in temperature, when most of the long-term pupae are formed. The first alternative is impracticable under present conditions, as the crop would not become established or mature, owing to lack of moisture, but if seasonal flooding or irrigation were available, it would give complete control ; rice could be grown on floodland in the rainy season and cotton could be planted on floodland or under irrigation in April and uprooted in November, which would allow little survival from long-term pupae. The second alternative would be difficult to carry out under present conditions, as land shortage compels the interplanting of cotton with food crops, which retards its subsequent growth and rate of fruiting. It has been shown, however, that where cotton is interplanted with maize, this effect can be mitigated by the date of planting and arrangement and spacing of the maize [*cf.* **34** 168]. The survival of the long-term pupae formed in May–July could be reduced by hoeing immediately after uprooting and by protecting the soil surface with a mulch of maize haulms and other plant residue, since both these treatments increase the activity of predators, and the mulch, by reducing soil temperatures, reduces the proportion of pupae that remain in diapause until the new cotton season starts. If this method of control were adopted, the prohibition of cotton-growing in the area for one complete season would prevent a heavy survival of long-term pupae from the last season under the present system.

It is stated in a foreword that the Government has considered the Report and proposes to arrange for a survey to determine the possibility of reclaiming floodland in the Lower River area with a view to controlling *Diparopsis* by late planting and also to increasing agricultural production in the area. If the survey should show this to be impracticable, the recommendations for a cotton-free year followed by the introduction of early cropping and the agricultural measures ancillary to it will be adopted.

TOOKE (F. G. C.). **Beetles attacking seasoned Timber in South Africa. Part I. The Common Furniture Beetle** *Anobium punctatum*, **De Geer.**—*Bull.* [*Dep. Agric. For. S. Afr.*] no. 246, 15 pp., 5 figs., 7 refs. Pretoria, 1944.

The author briefly discusses the recent occurrence of *Anobium punctatum*, Deg., in South Africa, describes all stages of this Anobiid, its life-history and the damage it causes to wooden furniture and constructional timbers and gives details of methods of preventing or controlling infestation [*cf. R.A.E.*, A **34** 12].

LEPAGE (H. S.) & GIANNOTTI (O.). **Experiências com o D.D.T.** [Experiments with DDT.]—*Biológico* **10** no. 11 pp. 353–366, 1 fig., 4 refs. São Paulo, 1944.

An account is given of further experiments with DDT in São Paulo [*cf. R.A.E.*, A **33** 288]. In the first, Gesarol P (3 per cent. DDT in talc) was mixed with small lots of uninfested maize in jars in proportions of 1 : 1,500, 1 : 3,750 and 1 : 7,500, and 100 adults of *Calandra* (*Sitophilus*) *oryzae*, L., were introduced into each. The jars were examined daily and it was found that complete mortality had resulted after 185, 234 and 504 hours, respectively, in the three series, as compared with 10 per cent. after 504 hours in control maize mixed with talc at the highest rate. It is concluded that Gesarol P in the proportion of about 1 : 5,000 would be effective for practical purposes. In further tests, dusts containing 1, 2, 4, 8 and 16 per cent. DDT in talc were mixed at this rate with small lots of maize in jars, and 80 adults were introduced into each. The jars were examined daily and the dead weevils counted. Weevils in all the experimental series showed partial paralysis of the legs after 48 hours. There was little mortality in the controls, and it is calculated that the average periods required for complete mortality were 260, 220, 190, 175 and 170 hours, respectively, for the five concentrations of DDT. The lowest concentration was thus satisfactory at the rate chosen. After the removal of the dead weevils, fresh lots of 40 were placed in each lot of maize, with no further DDT, and these again replaced when they were all dead. After 40 days, the original population in the control jars had fallen by 50 per cent., whereas five successive lots of weevils had all been killed by the two highest concentrations of DDT, four lots by the next two, and two lots by the lowest. The DDT was still effective at the end of the period, and it is concluded that under these conditions it remains so for at least 60 days. In a similar comparative test, Gesarol P at 0·06 per cent.

killed six successive lots of 100 weevils in maize in 40 days, while ground timbo root (6 per cent. rotenone) at 0·12 per cent. killed only 90 per cent. of the first lot throughout the same period, and pyrethrum powder (0·5 per cent. pyrethrins) at 0·18 per cent. killed all the first batch in 14 days but less than 50 per cent. of the second in 20 days.

Experiments were then made on a commercial scale, Gesarol P being mixed at rates of 1 : 5,000, 1 : 2,500 and 1 : 1,666 with infested maize in sacks. The sacks were stored in the ordinary way among other similar ones, and the weevils were counted after a week. The percentages dead were 95, 100 and 100, respectively, in one test, and 80 and 90 in another in which only the first two rates of application were used, the mortality in the control in this case being 9 per cent. Treatment with Gesarol P at 1 : 1,000 had no injurious effect on the viability of the seed or the subsequent development of the plants, and other tests showed that, although DDT is insoluble in water, much of it was removed when treated maize was washed twice. It is thought therefore that treated maize used for industrial purposes, such as the manufacture of glucose, would be freed from almost all the DDT in it by the routine washings involved.

Results obtained by other workers who investigated the toxicity of DDT to mammals and birds [B **33** 78, 84] are summarised, and tests are described in which Gesarol P was administered to rabbits and Gesarol A (3 per cent. DDT) to month-old chicks in their daily food (up to 188 gm. in 17 days and 3 gm. in 30 days, respectively) and hens were fed for 30 days on maize treated with Gesarol P at 1 : 5,000 or given a single dose of 1 gm. pure DDT dissolved in castor oil, all without toxic effects.

Bruchus (*Acanthoscelides*) *obtectus*, Say, proved more susceptible to DDT than *C. oryzae*, and complete mortality was given in 48 hours when 0·05 per cent. Gesarol (containing 3 per cent. DDT) was mixed with infested beans. It is thought that 0·01 per cent. would be equally effective in 3–5 days.

Potato tubers kept for seed from one season to the next in São Paulo are commonly infested by *Pseudococcus* spp., chiefly *P. maritimus*, Ehrh., and *P. comstocki*, Kuw., but the mealybugs were destroyed and reinfestation prevented by mixing Gesarol P with stored tubers. A DDT spray (Gesarol A) was less effective and was injurious to the tubers unless special arrangements were made for drying them. A 1 per cent. spray of Gesarol A in water effectively controlled *Trialeurodes* and other Aleurodids in greenhouses, without injuring the plants, and should be applied at intervals of a month. A test on house-flies is dealt with elsewhere [B **34** 170].

SAUER (H. F.) & DUVAL (G.). **O combate à formiga saúva no Estado de S. Paulo.** [The Control of Leaf-cutting Ants in the State of São Paulo.]—*Biológico* **11** no. 3 pp. 69–74, 1 map, 1 graph. São Paulo, 1945.

A campaign is in progress in São Paulo to control leaf-cutting ants [chiefly species of *Atta*], and information is given on the results obtained in 1944, when the ants in over 10,000 nests were destroyed on 1,850 properties throughout the State by fumigation with carbon bisulphide introduced through artificial channels.

PINTO DA FONSECA (J.). **A lagarta verde dos capulhos do algodoeiro.** [The Green Cotton Bollworm.]—*Biológico* **11** no. 4 pp. 110–111. São Paulo, 1945.

In view of recent reports of the occurrence of *Heliothis* (*Chloridea*) *virescens*, F., on cotton in São Paulo [*cf. R.A.E.*, A **33** 278, etc.], the author briefly describes the appearance of all stages and the bionomics of this Noctuid. The larvae are difficult to control by insecticides, but a spray of 2 lb. Paris green, 3 lb. lead arsenate and 10 lb. cassava starch in 100 gals. water is recommended.

it should be applied as soon as infestation is observed and directed principally to the lower surfaces of the leaves. Other control measures are ploughing immediately after harvest to destroy the pupae and the destruction of all crop remains.

MADDEN (A. H.) & CHAMBERLIN (F. S.). **Biology of the Tobacco Hornworm in the southern Cigar-tobacco District.**—*Tech. Bull. U.S. Dep. Agric.* no. 896, 51 pp., 24 figs., 32 refs. Washington, D.C., 1945.

A detailed account is given of investigations on the bionomics of *Protoparce sexta*, Joh., on tobacco in Florida, carried out in 1936–41; the results of the first two years have already been noticed [*R.A.E.*, A **27** 251]. All stages of this Sphingid are described, its economic importance, distribution and synonymy are discussed, and notes are given on related species and on its food-plants, all of which are solanaceous in that area. There are four overlapping generations in the year [*cf. loc. cit.*], and some adults of the fourth may emerge in autumn under favourable conditions; winter is passed in the pupal stage. Adult emergence begins in the second half of April, and adults of the first, second and third generations appear in mid-June, early August and mid-September; eggs and larvae are present until late October or early November, when they are killed by the first sharp frost. The total population of all stages usually reaches a peak during July, followed by a sharp decrease at about the beginning of August.

The adults were found to mate only once; feeding (on *Datura* flowers) preceded oviposition under cage conditions and increased the numbers of eggs laid, but oviposition could take place in the absence of food. The pre-oviposition, oviposition and post-oviposition periods averaged 1·8, 6·4 and 1·5 days, respectively. The average numbers of eggs per female were 302 for those reared from larvae collected in the field and 202 for those from larvae reared in captivity, and the maximum was 1,133. Twice as many were laid on the lower as on the upper leaf surface in cages and four times as many in the field; very few were laid on the stems. Under field conditions, the number deposited on individual plants during the growing season ranged up to 74; most were on the largest and most vigorous plants, and on the upper third of the plant. There was no significant difference between the numbers at the edges and in the centre of an open field or between those on plants near woods or other cover and at a distance from them. In general, weather appeared to have little effect on oviposition, though it was reduced by heavy rain accompanied by a marked fall in temperature. No evidence was obtained to confirm the popular belief that the number of eggs deposited increases with the intensity of moonlight. Only 79 per cent. of the eggs laid in cages hatched, as compared with 95 per cent. of those collected in the field. The duration of the larval stage averaged 19·7 days in the insectary and 16·5 days in a field cage. The incubation and larval periods were not affected by humidity but varied inversely with the mean temperature. Mature larvae drop to the ground and burrow to an average depth of 5½ ins. The prepupal and pupal stages lasted 3–8 and 14–405 days, respectively, in the insectary, but some pupae from field-collected larvae gave rise to adults after more than two years, the maximum observed being 738 days. The percentage of pupae surviving hibernation varied from 20 to 53; the lowest winter temperatures of the area appeared to have no effect on winter mortality.

SNAPP (O. I.). **Further Experiments with Dichloroethyl Ether for Plum Curculio Control.**—*J. econ. Ent.* **38** no. 4 pp. 417–418, 2 refs. Menasha, Wis., 1945.

In further field experiments on the control of *Conotrachelus nenuphar*, Hbst. on peach carried out in Georgia in 1942–44 [*cf. R.A.E.*, A **31** 191, etc.], dichlorethyl-ether emulsion was applied twice to the soil under peach trees at a concentration of 1·5 per cent. when hardly any of the first-generation larvae had pupated and again at 4·5 per cent. when most of them had done so. The emulsion was used at the rate of approximately 1 U.S. gal. per six square yards of soil, about 1, 2 and 3 U.S. gals. being applied under trees of small, medium and large size. In 1942, the percentages of ripe peaches infested were 9·1 for the regular spray schedule of 2 lb. lead arsenate and 8 lb. hydrated lime per 100 U.S. gals. at petal-fall, sepal-fall and, with the addition of 8 lb. zinc sulphate, four weeks before harvest; 14·5 for the two applications of dichlorethyl-ether emulsion; 12·8 for this treatment preceded by a spray of lead arsenate applied at sepal-fall against the overwintered adults; and 13·5 for the same treatment with nine jarrings to collect overwintered adults. In 1943 and 1944 they were 16·1 and 1·2, respectively, for the regular schedule of 2 lb. lead arsenate, 8 lb. lime and 2 lb. zinc sulphate per 100 U.S. gals. at petal-fall, sepal-fall and four weeks before harvest; and 16·8 and 2·4, respectively, for the two applications of dichlorethyl-ether. The differences between treatments were not significant, but the dichlorethyl-ether caused no injury to the trees or to the vegetation under them, whereas the lead-arsenate sprays caused moderate to severe injury to foliage and budwood in July, moderate to severe defoliation by September, and some scorching of fruit in two of the three years, in spite of the use of zinc sulphate as a safener.

Snapp (O. I.). **Propylene Dichloride for Peachtree Borer Control: second Report.**—*J. econ. Ent.* **38** no. 4 pp. 419–422, 1 ref. Menasha, Wis., 1945.

In further tests against *Aegeria* (*Sanninoidea*) *exitiosa*, Say, carried out in commercial peach orchards in Georgia in 1943–44 [*cf.* *R.A.E.*, A **32** 206], the emulsion of propylene dichloride applied in October at rates of ½ U.S. pint 10 per cent. emulsion to trees 4–7 years old, ½ U.S. pint 7·5 per cent. emulsion to three-year-old trees and ¼ U.S. pint. 7·5 per cent. emulsion to two-year-old trees was as effective as ethylene-dichloride emulsion applied at the same rates and twice the concentration, and caused practically no tree injury; ⅛ U.S. pint 5 per cent. propylene dichloride was as effective as the same amount of 7·5 per cent. ethylene dichloride on one-year-old trees. Propylene dichloride at the reduced strength was more effective than ethylene dichloride against borers in the trees at unusual depths below the ground. Increasing the concentration of propylene dichloride to 12·5 per cent. in 1943 resulted in no injury to two-year-old trees, and increasing it to 10–20 per cent. in 1944 caused little to three-year-old ones, indicating that there is a fair margin of safety at the strengths required for a high degree of control. The use of broken-down emulsions of propylene or ethylene dichloride resulted in reduced control and some bark injury. The results obtained indicated that on sandy loams and clay loams it is unnecessary to break the surface crust of soil before treatment with either material to prevent run-off. Since propylene and ethylene dichloride cost approximately the same, and less propylene dichloride is required for effective control, this is the cheaper treatment.

Hough (W. S.), Clancy (D. W.) & Pollard (H. N.). **DDT and its Effect on the Comstock Mealybug and its Parasites.**—*J. econ. Ent.* **38** no. 4 pp. 422–425. Menasha, Wis., 1945.

An account is given of preliminary experiments carried out in Virginia in 1944 to determine the effect of DDT sprays on *Pseudococcus comstocki*, Kuw., and its parasites in the laboratory and in an apple orchard; the main results as regards the mealybug have already been noticed [*R.A.E.*, A **34** 105–106]. Adults of the parasite, *Pseudaphycus* sp., were very susceptible to spray deposits of DDT at concentrations of ½–2 lb. per 100 U.S. gals. in the laboratory, and in the orchard parasitism was reduced when DDT sprays were applied, but increased rapidly after spraying was discontinued in August. The parasites reared were *Allotropa burrelli*, Mues., *Pseudaphycus* sp. and *Clausenia purpurea*, Ishii.

ORR (L. W.) & MOTT (L. O.). **The Effects of DDT administered orally to Cows, Horses, and Sheep.**—*J. econ. Ent.* **38** no. 4 pp. 428–432, 1 ref. Menasha, Wis., 1945.

The following are the authors' conclusions. The results of these tests in which large amounts of DDT were administered to cows, horses, and sheep, as a dry powder or in water suspension, indicate that the chemical is not acutely toxic. Most of the material is evidently eliminated from the body, although small quantities may be taken up by the blood stream. Haemorrhages are frequently produced in the heart and in the lining of the intestines. There is usually a marked loss of appetite, probably associated with the intestinal lesions, which may prove of importance in keeping animals from ingesting large quantities of the chemical over a prolonged period. The nervous system is likely to be affected, although there appears to be a marked variation between species and between individuals of the same species in their susceptibility to effects from the chemical.

There is some indication that individual animals develop a tolerance to DDT, although much additional study is needed on this and other phases of the problem. The effects of DDT dissolved in oils or other organic solvents should be determined, as it is possible that solutions of the chemical would be much more readily assimilated. The results of the present tests do not, however, give reason to expect any bad effects on domestic animals from the proper use of DDT as an insecticide when applied as a dust or in water suspension.

BRUCE (W. N.) & TAUBER (O. E.). **Trials with DDT on Potatoes, Cabbage, and Squash.**—*J. econ. Ent.* **38** no. 4 pp. 439–441. Menasha, Wis., 1945.

The tests described in this paper were carried out in Iowa in 1944, and all dusts were applied at the rate of 50–60 lb. per acre. A dust containing 3 per cent. DDT applied five times at intervals of about ten days controlled *Macrosiphum solanifolii*, Ashm., *Epitrix cucumeris*, Harr., and *Empoasca fabae*, Harr. (*mali*, LeB.) on potato and increased the yield by nearly 70 per cent. A 1 per cent. DDT dust was effective against *Empoasca* and reduced Aphid infestation, but did not give adequate control of *Epitrix*, and a 0·25 per cent. DDT dust caused some reduction in the population of leafhoppers and Aphids, possibly owing to repellence. DDT at these concentrations caused no plant injury. Dusting sulphur was effective against the leafhopper.

In tests against *Pieris rapae*, L., on cabbage, dusts of DDT and derris (1 per cent. rotenone) were applied six times at intervals of 10–14 days during the growing season. The average percentage reductions in leaf area due to feeding by the larvae were 0, 0·75 and 1·07 for 3, 1 and 0·25 per cent. DDT, respectively, 0·74 for the derris dust, and 11·5 for no treatment. The average yields were directly correlated with these percentages. The DDT dusts caused no damage to the plants.

Dusts were also applied to two varieties of squash five times during the summer at intervals of 10–14 days, and one containing 3 per cent. DDT gave almost complete control of *Melittia satyriniformis*, Hb. On one variety, in which untreated plants produced no marketable fruits, the yields were 52·2, 43·2, 27·5, 21·5 and 20·5 lb. for 3, 2, 1, 0·5 and 0·25 per cent. DDT, respectively, and 21·9 lb. for 8 per cent. calcium arsenate; the results on the other were similar, 3 per cent. DDT giving twice as much yield as 1 per cent. rotenone. Neither variety showed any foliage injury due to DDT, but a third variety of squash and some varieties of musk-melon were retarded in development, especially during the earlier periods of growth, when dusted with it.

Poos (F. W.). **The Control of Tobacco Thrips on Seedling Peanuts.**—*J. econ. Ent.* **38** no. 4 pp. 446–448, 1 fig., 3 refs. Menasha, Wis., 1945.

Investigations were made in 1944 to estimate the loss of crop caused to ground-nuts by *Frankliniella fusca*, Hinds [*cf. R.A.E.*, A **30** 359] and to develop insecticide treatments for controlling it. They were carried out at Beltsville, Maryland, since young ground-nut plants are there heavily and evenly infested with the thrips, but the diseases caused by *Cercospora* and *Sclerotium rolfsi* occur rarely if at all. The seed was planted on 27th May, dusts were applied seven times and other treatments eight times between 7th–8th June and 7th–8th July, and harvesting was completed on 10th October. As many of the pods do not mature in the latitude of Beltsville, yields were recorded as the green weight of the entire plant, which has been shown in Virginia to be correlated with the yield of field-cured ground-nuts. The percentage increases in yield over the controls were : 32·4 and 37·6 in two experiments for a spray containing 0·66 per cent. DDT with a wetting agent and a sticker ; 30·3 and 32·6 for a dust of 2 per cent. DDT in pyrophyllite ; 27·9 (in the first experiment) for a DDT aerosol containing 10 per cent. DDT, 10 per cent. cyclohexanone, 10 per cent. lubricating oil, 20 per cent. acetone and 50 per cent. methyl chloride ; 21·4 and 20·9 for a concentrated spray of tartar emetic, brown sugar and water applied at approximately 2 U.S. gals. per acre ; 7·4 (in the first experiment) for pyrethrum powder impregnated with 3 per cent. petroleum hydrocarbons (0·5 per cent. pyrethrins) ; and 5·9 (in the second experiment) for a sulphur dust. The large increases given by DDT show that the thrips causes significant injury, and that attempts at control are justified. Little, if any, of the increase in yield was due to the control of other insects ; the potato leafhopper [*Empoasca fabae*, Harr.] is not normally injurious to ground-nuts until the major attack by thrips has subsided, and all the plots were dusted with sulphur on 26th July and 9th August to control it. No thrips injury was evident in plots treated with DDT, whereas the plants in untreated plots were severely injured in the seedling stage and had not equalled the treated plants in growth by harvest time. It is thought that two or three applications of the DDT dust, spray or aerosol at intervals of 7–10 days would give control in normal weather.

Dried samples of plants treated with DDT in the spray, dust and aerosol showed residues of 20·5, 34 and 30 parts DDT per million ; it was not practicable to determine the rates of application of DDT because of the small size of the plots.

Tenhet (J. N.). **Laboratory Tests of Insecticides for Tobacco Moth and Cigarette Beetle.**—*J. econ. Ent.* **38** no. 4 pp. 449–451, 1 ref. Menasha, Wis., 1945.

An account is given of experiments in Virginia in 1942–43 in which substitutes for pyrethrum dust for the control of *Ephestia elutella*, Hb., and *Lasioderma serricorne*, F., on stored flue-cured tobacco were tested in a modified Peet-Grady chamber [*cf. R.A.E.*, A **32** 381]. Of a number of insecticides applied as aerosols with liquefied dichlordifluoromethane and methyl chloride (1 : 1) as the propellent, none gave satisfactory mortality of adults of *Lasioderma* and only a few had any effect on eggs of *Ephestia*, but four aerosols containing pyrethrum extract (alone or with sesame oil, kerosene and sesame oil, or rotenone), and four others, which contained methylated naphthalene, butyl thiocyanate, acrylonitrile with oleic acid, and bromoform, gave complete mortality of adults of *Ephestia*. A proprietary preparation consisting of 14 per cent. nicotine in a combustible powder, which develops sufficient pressure to generate a nicotine aerosol when ignited in a partly closed container, was only moderately effective against the moths and ineffective against the beetles. Of the dusts and sprays tested, only sprays of pyrethrum extract in oil (0·2 per cent. pyrethrins) [*cf. loc. cit.*], pyrethrum extract (0·1 per cent. pyrethrins) with 4·8 per cent. butyl thiocyanate in oil, DDT in oil [*cf. loc. cit.*] and various mixtures of methylnaphthalenes in oil were considered effective against adults of *Ephestia* (at least 90 per cent. moribund in 24 hours). DDT in oil was relatively ineffective against adults of *Lasioderma* at concentrations of 3 and 5 per cent. [*loc. cit.*], and no more effective at 5 per cent. with 4 per cent. butyl thiocyanate, but the percentages moribund after 24 hours and dead after 5 days increased to 62·5 and 89·5 when an acetone solution was added to the oil to give a concentration of 10 per cent. DDT. The other sprays and the dusts were much less effective. Since tobacco sprayed with methylnaphthalenes retained an objectionable odour of naphthalene, these materials are not suitable for use on stored tobacco.

WALTON (R. R.) & WHITEHEAD (F. E.). **Tests of Ingredients of Grasshopper Baits.**—*J. econ. Ent.* **38** no. 4 pp. 452–457, 4 refs. Menasha, Wis., 1945.

The results are given of experiments carried out in Oklahoma in 1936, 1937 and 1939 in which various baits for the control of grasshoppers were compared with a standard bran bait ; the results obtained in 1936 have already been noticed [*R.A.E.*, A **26** 138–139]. In 1937 and 1939 all tests were made in lucerne fields, where *Melanoplus differentialis*, Thos., *M. packardi*, Scud., *M. mexicanus*, Sauss., *M. bivittatus*, Say, and *M. foedus* subsp. *iselyi*, Hebard, were the dominant species. The primary objective was to find inexpensive yet efficient carriers. Bran was the most attractive carrier tested, however, and with one exception, more effective than the others. The addition of bran, mill-run bran or wheat shorts to other carriers improved their attractiveness and effectiveness, and the value of mixtures of bran and sawdust increased with an increase in the proportion of bran used, all being definitely better than sawdust alone. A 1 : 1 mixture of mill-run bran and sawdust, however, was not significantly more effective than a 1 : 3 mixture, possibly because any increase in attractiveness was counteracted by the poorer spreading quality of the mixture. The mixture of bran and sawdust (1 : 1) used in 1936 [*cf.* **26** 139] was usually replaced by one of mill-run bran and sawdust (1 : 3) in later years ; both these baits were generally effective. Cotton-seed husks were about as effective as sawdust, both alone and in combination with bran or mill-run bran ; grinding them did not increase their effectiveness. Baits of sawdust, cottonseed husks and mixtures of these with bran or mill-run bran were more effective in comparison with bran alone when used under conditions of drought than when spread in succulent vegetation. Baits containing 1 part *Citrus* pulp, a by-product of the manufacture of grapefruit juice, ground to the consistency of maize meal and mixed with 3 parts sawdust or cottonseed hulls, or ground to a fine powder and mixed with 9 parts, were about as effective as bran and gave the best results of any of the non-bran baits tested. Ground lucerne leaves did not increase the effectiveness of cottonseed husks or sawdust, and reduced the effectiveness of bran more than did cottonseed husks or sawdust. There was little difference between baits of bran and water and of bran and lubricating oil over periods of several days, but all baits containing a low-grade fuel oil were distinctly inferior to similar carriers with water or lubricating oil.

WALTON (R. R.) & WHITEHEAD (F. E.). **The Influence of Temperature, Clouds and Time of Day upon the Feeding of Grasshoppers on Poison Bait.** —*J. econ. Ent.* **38** no. 4 pp. 458–463, 1 fig., 6 refs. Menasha, Wis., 1945.

During bait tests in Oklahoma [see preceding abstract], information was obtained on the effect of temperature, clouds and time of day on the feeding of grasshoppers (*Melanoplus* spp.). It was found that they fed at mean air temperatures of 64–96°F., the temperature at which there was maximum feeding varying from 70 to 88°. Feeding was at a maximum at mean soil-surface temperatures of 89–112° and declined rapidly at higher ones. The relation between air and soil temperatures and feeding is discussed and compared with the results obtained by other workers [*cf. R.A.E.*, A **29** 604, etc.].

Tests on days of alternate clear and cloudy weather showed no definite trends in feeding, probably because the periods involved were too short to cause any significant changes in the numbers feeding, but a comparison of predominantly clear and predominantly cloudy days showed that the numbers feeding were usually distinctly greater on clear days. It appears that clouds affect feeding through their influence on the temperature; a cloudy sky has a tendency to decrease the soil-surface temperature in relation to air temperature. It seems likely that if the air temperature were near the lower end of the range of normal activity, clouds would retard feeding, whereas temperatures near the higher end of the range would permit feeding to continue longer, and a study of the results of individual plot-cage tests with adults of *M. differentialis*, Thos., confirmed these assumptions. However, very few cloudy days occur during hot weather in Oklahoma, and the results showed that in this State cloudy days are usually less favourable than clear ones for poisoning grasshoppers. It was found that maximum feeding occurred between 7 a.m. and 2 p.m., the peak being usually before 11.30 a.m., and this suggests that it is desirable to spread the baits before this time. Nevertheless, bait should not be spread until the air or soil surface has reached 68–70°F., at which temperature normal activity usually begins.

SCOTT (L. B.). **Arsenical Residues in Straw and Grain from Wheat dusted by Airplane or treated with poisoned Bait.**—*J. econ. Ent.* **38** no. 4 pp. 464–466, 4 refs. Menasha, Wis., 1945.

In May 1944, a moderately severe infestation by *Cirphis unipuncta*, Haw., on wheat and barley in Tennessee was controlled by broadcasting a bait of bran and Paris green (100 : 3 or 100 : 4) at the rate of 20–30 lb. per acre, or by applying a dust of calcium arsenate and Paris green (9 : 1) from an aeroplane at the rate of about 20 lb. per acre. The aeroplane flew about 15 ft. above the ground, soon after dark when there was comparatively little air movement, and excellent coverage resulted, but enough dust carried to adjoining fields to deposit visible residues. Observations on several treated fields showed that both the bait and the dust reduced infestation by about 90 per cent. in 72 hours; the bait acted rather more quickly as it was on the ground, and the larvae fed on it at all times, whereas the dust adhered to the foliage, which was eaten freely only at night and during the cooler part of the day. Shortly after the dust was applied, reports were received of dead rats, mice, cats, dogs and rabbits in or near the dusted fields, and of illness in one herd of cows due to feeding on contaminated pasture.

Wheat straw analysed for arsenical residues between 20th June and 6th July showed 6·21–21·59 mg. arsenic trioxide per lb. from dusted fields, 1·68 mg. from fields treated with the bait and 0·23 mg. from an untreated field half a mile from the nearest dusted one. Tests on 11th August showed residues of 2·86–4·13 mg. per lb. for dusted fields, 2 mg. for baited fields and 0·18 mg. from a field four miles from the nearest dusted one. From these results and from estimates made by other workers of the toxic dose of arsenic for cattle and horses, it is concluded that by 20th June, a horse would have to eat 88 lb. of the straw bearing the highest residue and a cow 33 lb. to obtain a dangerous dose of arsenic, and by 11th August the residue remaining on the straw in the field was well below the danger point, though it was possible that stacked straw from dusted fields might still contain enough arsenic to be dangerous to stock that fed on it heavily and continuously. The arsenical residue on straw from baited fields was far below the danger point, so that the bait is safe to use provided that it is properly handled and applied. Samples of threshed wheat from all the fields investigated, including the untreated ones, contained traces of arsenic, but in no case did the residue approach a dangerous amount.

CHISHOLM (R. D.) & KOBLITSKY (L.). **Variation in Composition and Volatility of Japanese Beetle Attractants during Evaporation.**—*J. econ. Ent.* **38** no. 4 pp. 467–470, 3 refs. Menasha, Wis., 1945.

Since compounds of varying purity and of different vapour pressures are used in mixtures of volatile liquids employed to attract insects, the composition of the vapours evolved and the rates of vaporisation may vary. The results are here given of a study of the extent to which these changes take place during the evaporation of several liquid attractants for *Popillia japonica*, Newm., dispersed by means of a bottle and wick.

In one series of tests, fractional distillation under reduced pressure was used, and the boiling point and refractive index of each fraction were measured; the results are shown in tables and indicate that anethol, eugenol and Deobase (refined kerosene) are relatively pure compounds, geraniol is a mixture of somewhat different compounds and a mineral oil (125–135 secs. Saybolt) a mixture; that a mixture of anethol and eugenol (9 : 1) will evaporate more rapidly than one of geraniol and eugenol [*cf.* *R.A.E.*, A **32** 373]; and that a mixture of geraniol, eugenol, Deobase and mineral oil is variable in rate of evaporation.

In another series of tests, the attractants were put in bottles containing hollow cylindrical wicks and allowed to evaporate at normal temperature and pressure, and changes in the refractive index of the residual attractant in the wicks measured at successive weekly intervals were compared with the percentage of the charge evaporated during these intervals. The data obtained indicate that the initial rates of evaporation of the several attractants differed considerably, both within and between mixtures, that most of the rates decreased as evaporation progressed, and that in general the composition of the attractant in the wick was variable, possibly owing partly to decomposition on exposure to air and light and partly to a more rapid vaporisation of the more volatile constituents. The refractive index of most of the liquids in the bottles remained almost constant throughout the four-week period; a change in that of a mixture of geraniol, eugenol, Deobase and mineral oil indicated partial evaporation of the highly volatile Deobase from the mixture in the bottle.

Since the attractiveness of the vapours of certain compounds to insects is sometimes modified by the concentration of the vapours, it is apparent that the composition of these and the rate of evaporation should be considered in the formulation of attractants.

RICHARDSON (C. H.) & WALKDEN (H. H.). **β-Methylallyl Chloride as a Fumigant for Insects infesting stored Corn.**—*J. econ. Ent.* **38** no. 4 pp. 471–477, 17 refs. Menasha, Wis., 1945.

The following is based on the authors' summary. The results are given of investigations on the use of β-methallyl chloride for the fumigation of shelled maize. Its physical characteristics, low inflammability and effect on human health suggest that it can be used successfully provided that reasonable precautions are taken. In laboratory tests with small gas-tight containers, both empty and almost full of maize [*cf.* next abstract], the compound was about equally toxic to adults of *Tribolium castaneum*, Hbst., *Oryzaephilus surinamensis*, L., and *Calandra* (*Sitophilus*) *oryzae*, L., the dosages in cc. per litre required for 50 and (in brackets) 95 per cent. mortality being 0·0088 (0·0118), 0·0066(0·0092) and 0·0055 (0·0082), respectively, with 24 hours' exposure at 30°C. [86°F.] in empty space. A mixture of 75 per cent. β-methallyl chloride and 25 per cent. carbon tetrachloride was not distinguishable in effectiveness from β-methallyl chloride alone, but reductions in the percentage of β-methallyl chloride in the mixture caused a reduction in toxicity to the three insects. However, a mixture containing as little as 16·7 per cent. was still equally toxic to *T. castaneum* and *C. oryzae*, whereas carbon tetrachloride alone was more toxic to the former. As the β-methallyl chloride content of the mixture was decreased below 16·7 per cent., its toxicity to these insects approached that of carbon tetrachloride alone.

In tests in shelled maize stored in steel bins with a capacity of 2,000 and 2,740 bushels, mixtures of carbon tetrachloride with 12·5–16 per cent. β-methallyl chloride applied at a dosage of 2 U.S. gals. per 1,000 bushels gave 93 and 94 per cent. kills of the three test insects, and for practical use a mixture containing 20 per cent. β-methallyl chloride, applied at the rate of 2 U.S. gals. per 1,000 bushels of shelled maize stored in steel bins is suggested.

No deleterious effect on germination was observed in maize or wheat containing 9·1 per cent. or less moisture when it was fumigated with β-methallyl chloride at dosages up to 1 cc. per 5 lb. (2·96 U.S. gals. per 1,000 bushels) and exposures up to 168 hours; 1 cc. per 5 lb. is about 13 times the maximum required to kill 95 per cent. of the test insects under the same conditions. Injury to germination increased with dosage and with the moisture content of the grain. A mixture of ethylene dichloride and carbon tetrachloride (3 : 1), tested for comparison, caused no observable reduction in the germination of maize and wheat.

RICHARDSON (C. H.). **Fumigants for the Cadelle in shelled Corn.**—*J. econ. Ent.* **38** no. 4 pp. 478–481, 14 refs. Menasha, Wis., 1945.

The results are given of experiments in which fumigants were tested against adults of *Tenebroides mauritanicus*, L., in gas-tight jars with a capacity of 1 U.S. gal. containing 5 lb. dry shelled maize, which occupied about 80 per cent. of the space. Ten test insects in screen-wire cages were put on the bottom of the jar, 6½ inches below the surface of the grain, on which the fumigant was dropped from a micropipette. All exposures were for 24 hours at 30°C. [86°F.]. The insects were then given moist cracked cereal food and moisture and examined after 4, 9 and 13 days. The median lethal dosages and (in brackets) the dosages required for 95 per cent. mortality, calculated from the results obtained at the last inspection, were 0·027 (0·034) gm. for 1,1-dichlor-1-nitroethane, 0·043 (0·078) gm. for ethylene dibromide, 0·129 (0·104) gm. for carbon bisulphide, 0·191 (0·256) gm. for a mixture of methyl bromide and carbon tetrachloride (1 : 9 by volume), 0·438 (0·723) gm. for carbon tetrachloride, 0·508 (0·817) gm. for 1,1,2-trichlorethane and 0·585 (1·135) gm. for ethylene dichloride per 5 lb. maize. Two mortality curves were obtained for β-methallyl chloride, the first about five weeks before the second; the similarity of the median lethal dosages (0·121 and 0·1 gm.) and the dosages required for 95 per cent. mortality (0·192 and 0·177 gm.) indicates that the resistance of the insects in the cultures to this compound remained stable during the period.

Comparison of the data with those for other insects attacking stored maize showed that the median lethal dose of carbon bisulphide, β-methallyl chloride, carbon tetrachloride and ethylene dichloride was about twice as high for

T. mauritanicus as for *Tribolium castaneum*, Hbst., *Oryzaephilus surinamensis*, L., and *Calandra* (*Sitophilus*) *oryzae*, L. It was observed at each of the three inspections that some individuals remained alive but unable to walk after exposure to some of the fumigants. This effect was most noticeable in the case of carbon tetrachloride and very slight in the case of 1,1-dichlor-1-nitroethane, ethylene dibromide and the mixture of methyl bromide and carbon tetrachloride. Carbon bisulphide was the only fumigant tested that revealed a marked reversible anaesthetic action. Revival was most noticeable at the intermediate dosages and 5–9 days after fumigation.

BALOCK (J. W.) & STARR (D. F.). **Adsorption of Methyl Bromide and its residual Effect on Fruitfly Mortality.**—*J. econ. Ent.* **38** no. 4 pp. 481–483, 1 graph, 3 refs. Menasha, Wis., 1945.

In the course of experiments carried out in Mexico City in 1941–44 on fumigation with methyl bromide against the immature stages of *Anastrepha ludens*, Lw., in mangos, it was observed that mortalities for the longer periods of exposure tended to be lower than was expected from calculations. This suggested that the dosages originally applied did not act equally against the entire population, which might be due to adsorption or absorption of the gas or to leakage, and the possibility of adsorption by the lining of the fumigation chamber and the fruit containers was investigated. The following is based on the author's summary. Chemical analysis indicated that of an initial dosage of 3 lb. per 1,000 cu. ft., about 36 per cent. was adsorbed by the wooden containers for fruit and 20 per cent. by the black paint, applied to the inside of the chamber to give better heat distribution. When the paint was removed, only 5 per cent. of the gas was adsorbed on the steel lining of the chamber. Window glass and asbestos-board panels were also tested for adsorption, with negative results. The reversal of the adsorption process was tested by sweeping the fumigation chamber with compressed air for ten minutes and then resealing. The gas concentration in the chamber increased from 0·13 lb. per 1,000 cu. ft. after 0·25 hour to 0·43 lb. after 40·66 hours, when it apparently reached equilibrium. Adults of *A. ludens* were enclosed for 15 hours in the chamber after it had been aired ; mortality was 95 per cent. after airing for three days and 58 per cent. even after airing for 23 days.

SWAIN (R. B.). **The Association of Nematodes of the Genus *Diplogaster* with White-fringed Beetles.**—*J. econ. Ent.* **38** no. 4 pp. 488–490, 4 refs. Menasha, Wis., 1945.

In the course of a study of Nematode parasites of *Pantomorus* spp. carried out in the south-east of the United States in 1940–44, several species of *Diplogaster*, including *D. aerivora*, were observed externally on larvae, pupae and adults, and in September 1940 Nematodes of this genus were found in the thorax of a living larva of *P. peregrinus*, Buchanan. It was apparent that the Nematodes were not always parasitic, and repeated attempts to infest healthy larvae were unsuccessful. Between April 1943 and August 1944, ten more larvae and adults of *Pantomorus* and one Elaterid larva were found alive and parasitised by *Diplogaster*. The Nematodes were commonest in the anterior part of the thorax, but some were dissected from the head.

In addition to *D. aerivora*, there are undoubtedly undescribed species of *Diplogaster* that at times enter and destroy *Pantomorus*. Their life-histories appear to be identical. The ensheathed third instar, the so-called " dauer " larva, is found free in the soil or adhering to larvae, pupae or adults of *Pantomorus* and sometimes enters the mouth or anus of the host and penetrates into the body cavity. Development to the adult stage and reproduction begin only after the death of the insect if the Nematodes remain attached to it externally, but sometimes occur before this if they penetrate its body cavity. Males and females are found in approximately equal numbers. The female is oviparous for most of its life, but eventually the larvae hatch within it and consume its body contents. The complete life-cycle requires 4–5 days.

The numbers of *Pantomorus* that succumb to direct attack by *Diplogaster* are not known, but it is assumed that relatively few do so, since these Nematodes have never been shown to give any significant control either in the laboratory or in the field. The feeding stages of *Diplogaster* ingest bacteria and can egest them in a living state, but it was not possible to draw final conclusions as to their potentialities as vectors of pathogenic organisms, and it was finally tentatively assumed that they are primarily saprophagous. *Diplogaster* is a serious pest in the artificial culture of *Neoaplectana* and in experiments on parasitism by that and other Nematodes [*cf. R.A.E.*, A **32** 195], since its shorter life-cycle and greater reproductive potential enable it to displace *Neoaplectana* in artificial cultures or dead insects. The distribution of *Diplogaster* in areas in which *Pantomorus* occurs is such that its full effect either as a parasite or as a possible vector of disease is probably already being realised, so that no useful purpose would be served by attempting to augment its populations artificially.

CHENG (Tien-hsi). **Field Tests of the Thunder God Vine against Melon Leaf Beetle.**—*J. econ. Ent.* **38** no. 4 pp. 491–492. Menasha, Wis., 1945.

The results are given of experiments carried out in northern Kwantung in 1943–44 on the use of the ground bark of the root of *Tripterygium forrestii* for the control of the Galerucid, *Aulacophora* (*Rhaphidopalpa*) *chinensis*, Weise, which is very destructive to watermelons in the south and east of China. The adults feed on both surfaces of the leaves, and young seedlings are sometimes completely defoliated. There is one generation a year, and the adults overwinter from October until late March among grasses.

The plants were dusted with the ground bark (120 mesh) every ten days for seven weeks from the time that the cotyledons appeared, after which they were less subject to attack and any injury was negligible. Applications were made in the early morning when the leaves were wet with dew. The dust caused no injury to the plants and had a strong repellent effect, only a small minority of the dusted seedlings being attacked and only 2–3 per cent. seriously damaged, whereas practically all the undusted plants were severely injured and many completely destroyed. It also evidently took effect as a stomach poison very rapidly, as groups of dead beetles were found on dusted leaves on which they had fed or on the ground beneath them. Its contact effect was not studied, but it was observed that less than 3 per cent. of the dusted plants were infested by Aphids, while over 70 per cent. of the undusted ones showed serious Aphid injury. The dusted plants yielded a good crop, but most undusted ones did not fruit at all. The dust was washed off by rain, and it was found necessary to repeat the treatment immediately after each shower, since if application was delayed for only 10–15 minutes, the beetles caused serious damage; attempts are being made to find a suitable adhesive. Preliminary experiments in which the powder was used against *Phyllotreta vittata*, F., and *Colaphellus bowringi*, Baly, on cabbage gave encouraging results.

Pigs and rabbits that fed on dusted watermelon leaves showed no apparent effects, and no cases of poisoning among persons who ate dusted cabbages have been reported.

WOLCOTT (G. N.). **DDT as a Termite Repellent.**—*J. econ. Ent.* **38** no. 4 p. 493. Menasha, Wis., 1945.

A brief account is given of tests in Porto Rico, the main results of which have already been noticed [*R.A.E.*, A **34** 172], in which samples of the wood of *Bursera simaruba* with dimensions of 1 × ¼ × 1¼ inches were dipped in solutions of DDT in benzene for ten minutes and exposed to attack by nymphs of *Kalotermes* (*Cryptotermes*) *brevis*, Wlk., in petri dishes with samples of the same wood impregnated with other chemicals and untreated samples of mahogany. A sample treated with 0·2 per cent. DDT was exposed to attack the day following immersion, but a few dead termites were noted on it an hour later, and it was therefore removed from the test, and none of the other samples was exposed for at least a fortnight after treatment. The numbers of days after immersion before termite attack was observed were 20–37 for concentrations of 0·02–1 per cent. DDT, but a sample treated with 2 per cent. DDT was still uneaten over a year later.

FLANDERS (S. E.). **A Barrier for confining crawling Organisms.**—*J. econ. Ent.* **38** no. 4 p. 495, 3 refs. Menasha, Wis., 1945.

In the course of rearing the potato tuber worm [*Gnorimoschema operculella*, Zell.] for the mass propagation of *Macrocentrus ancylivorus*, Rohw., in California [*cf. R.A.E.*, A **32** 367], open trays are used to receive the full-fed web-spinning larvae of the host, and it is necessary to employ a barrier to prevent their escape. An electric barrier of the type described by Swingle & Phillips [**31** 202] was found unsuitable because frequent cleaning was necessary, and an adhesive one at the top of the convex surface of the sides of a metal tray, which were rolled inwards so that the edge hung down to not less than an inch above its floor, involved some mortality of larvae and had to be renewed periodically, but a barrier using heat as the repelling agency and consisting of a single strand of wire of high resistance connected with the electric-light circuit and laid in the angle formed by the floor and sides of a wooden tray proved effective. The temperature of the wire should not be above that required to repel the larvae; this is lower than the temperature that causes charring of the wood. The wire should be slightly coiled to allow for expansion when it is heated. This type of barrier may be useful in confining many types of crawling organisms.

EWING (K. P.) & PARENCIA jr. (C. R.). **DDT for Control of the Cotton Flea Hopper.**—*J. econ. Ent.* **38** no. 4 pp. 495–496, 1 ref. Menasha, Wis., 1945.

Field-plot tests to compare the effectiveness of various concentrations of DDT in pyrophyllite with the standard mixture of calcium arsenate and sulphur (1 : 2) in controlling *Psallus seriatus*, Reut., on cotton were carried out in Texas in 1944. In one locality, in which five applications were made between 9th June and 4th July, the average number of fleahoppers per 100 terminals found in the course of five inspections between 12th June and 19th July was reduced from 157·2 for untreated plants to 32·7 by calcium arsenate and sulphur and to 95·4, 52·8 and 32·5 by dusts of 0·5, 1 and 2 per cent. DDT. The gains in yield over the control (708 lb. seed cotton per acre) were 262 lb. for calcium arsenate and 172, 275 and 420 for the three DDT dusts. The differences required for significance (at 19 : 1) were 21 in average number of fleahoppers and 75 lb. in yield.

In another locality, in which plants infested with an average of 73·2 fleahoppers per 100 terminals on 20th June were dusted four times between 21st June and 14th July, the average numbers for six inspections between 24th June and 27th July and (in brackets) the yield records in lb. per acre for the first picking and for the season were 61·1 (495 and 1,108) for no treatment, 22·8 (932 and 1,325) for calcium arsenate and sulphur, 24·8 (970 and 1,462) for 2 per cent. DDT in pyrophyllite, 20·2 (1,112 and 1,403) for 4 per cent. DDT in pyrophyllite, 22·9 (1,092 and 1,368) for a mixture of DDT, pyrophyllite and sulphur (2 : 18 : 80), and 23·6 (1,000 and 1,380) for a mixture of DDT, pyrophyllite, calcium arsenate and sulphur (6 : 54 : 80 : 160), the differences required for significance being 5·1 (146 and 129). The infestation records do not show whether the higher total yields from plots treated with 2 per cent. DDT in pyrophyllite were due to the greater residual effect of this treatment or to some other factor.

POTTS (S. F.), BRONSON (T. E.), LATTA (R.) & POOS (F. W.). **Atomized concentrated Sprays containing DDT to control Pea Aphid and Clover Leaf Weevil.**—*J. econ. Ent.* **38** no. 4 p. 497. Menasha, Wis., 1945.

In field tests in Maryland in 1944, a spray of DDT, cyclohexanone, lubricating oil (S.A.E.10) and fuel oil (20 : 20 : 30 : 30) was applied on 23rd April at the rate of 1·3 U.S. gals. (2·4 lb. DDT) per acre with a hand atomiser to part of a field of lucerne 3–6 in. high, which was uniformly infested by *Macrosiphum onobrychis*, Boy, (*pisi*, Kalt.). Rain fell a few minutes after treatment and continued for the rest of the afternoon. Sweeps made with a 15-in. net on 26th April and 4th and 9th May gave averages of 0·14, 0 and 1·6 Aphids per sweep, respectively, in the treated area and 99, 230 and 200 in the untreated area.

In a further test, a mixture of DDT, cyclohexanone, motor oil (S.A.E.10) and kerosene (20 : 20 : 15 : 45) was applied late in April to lucerne that was fairly heavily infested by *M. onobrychis* and *Hypera punctata*, F. It was atomised from a single point at one side of the field, and the resulting fine mist drifted across the field with the wind, which was blowing at 5–10 miles per hour; 2½ U.S. quarts were applied in about 20 minutes. Observations two days later showed approximate reductions of 90–100 per cent. in the population of the Aphid and of larvae of the weevil 200 ft. from the atomiser and 80 per cent. at 250 ft., while there was some reduction for up to 350 ft. In a similar test made a few days later against *M. onobrychis* in another lucerne field, about 1·33 U.S. pints of a similar mixture containing 10 per cent. DDT, 55 per cent. kerosene and enough pyrethrum extract to provide 0·1 per cent. pyrethrins was used to cover about a third of an acre (0·4 lb. DDT per acre) when a wind of 1–5 miles per hour was blowing; the population of the Aphid was reduced by more than 90 per cent. for the first 200 ft., more than 50 per cent. at 250 ft. and more than 40 per cent. at 300 ft., and there was some reduction up to 350 ft. These results suggest the possibility of using a light-weight portable atomising machine with a strong blower so that concentrated insecticide solutions drift over belts of hay or seed crops 100–200 ft. wide.

ROMNEY (V. E.) & CASSIDY (T. P.). ***Anaphes ovijentatus*, an Egg-parasite of *Lygus hesperus*.**—*J. econ. Ent.* **38** no. 4 pp. 497–498, 1 fig., 3 refs. Menasha, Wis., 1945.

In California, guayule (*Parthenium argentatum*) flowers continuously from April until autumn if moisture conditions are favourable, and so provides a suitable environment for *Lygus hesperus*, Knight, which reproduces in large numbers on the flowers. Examination of flowers during August 1944, when the Capsid had already produced two generations on guayule, showed that most of the eggs were inserted into the receptacle extending from the peduncle into the tissues of the flower heads. Of the 151 eggs found between 7th and 26th August, 42 showed evidence of parasitism, the percentage to do so increasing from 10 on 7th August to 70 on 25th August, and by 28th August, 21 females and 15 males of *Anaphes* (*Anagrus*) *ovijentatus*, Cr. & Leon., had emerged from them.

Occasional examples of *Lygus elisus*, Van D., were observed on the plants, and three of the 154 eggs found in the flowers appeared to be those of this species; they were smaller than those of *L. hesperus* and showed no sign of being parasitised.

THOMAS (W. A.). *Cyrtopeltis varians* **in some of the Tobacco-growing Areas of North Carolina.**—*J. econ. Ent.* **38** no. 4 pp. 498–499, 3 refs. Menasha, Wis., 1945.

In the summer and autumn of 1942, *Engytatus geniculatus*, Reut. (*Cyrtopeltis varians*, Dist.) was found on tobacco in most of the fields near Oxford, North Carolina, and it was associated with another Capsid, *Dicyphus minimus*, Uhl., which causes serious damage to the late primings of tobacco in North Carolina. It was observed that the population of *Dicyphus* decreased as that of *Engytatus* increased, that *Dicyphus* caused appreciable damage on some farms, on which *Engytatus* was scarce, and that *Engytatus* was feeding on both adults and nymphs of *D. minimus* to an extent that might account for its rapid reduction. In 1943 and 1944, *Engytatus* was widespread over much of the tobacco-growing area of North Carolina in the summer and autumn, and *Dicyphus* was scarce.

E. geniculatus was also observed feeding on newly hatched hornworms (*Protoparce*) and other small insects on tobacco, usually those caught on the gummy covering of the plant, and circumstantial evidence indicated that it punctures hornworm eggs before the shells harden, but not later. The nymphs and adults usually feed on the leaf-stems and veins of the growing tobacco and on the seed-stalks, buds, blossoms and seed clusters of maturing plants and suckers. They appear to do no permanent injury to the leaves or stems, but may cause economic damage when valuable seed is being produced, since the seed stalks are encircled with a ring of punctures, which causes the head to break off before the seeds mature. *E. geniculatus* does not apparently hibernate under the conditions prevailing at Oxford, and both nymphs and adults feed intermittently on native food-plants during the winter; mullein [*Verbascum*], which is common about old plant-bed sites, has been found infested during mid-winter.

WRAY (D. L.). **Swarming of Collembola in North Carolina.**—*J. econ. Ent.* **38** no. 4 p. 500. Menasha, Wis., 1945.

The author reports the occurrence of great swarms of *Hypogastrura* (*Achorutes*) *armata*, Nic., in February 1945 in several parts of North Carolina, where they were observed in tobacco plant beds, woods, ditches and fields that were being ploughed. Since the tobacco plants were only just coming up, no indications of damage were seen.

SMITH (C. F.). **Reduced Concentrations of Ethylene Dichloride for Peachtree Borer Control.**—*J. econ. Ent.* **38** no. 4 pp. 500–501. Menasha, Wis., 1945.

In tests against the peach tree borer [*Aegeria exitiosa*, Say] in North Carolina in 1942–44, ethylene-dichloride emulsion was applied in October to the soil around the trunks of 6- and 7-year-old peach trees in four orchards at a constant dosage of 8 fl. oz. per tree and varying concentrations, and paradichlorbenzene in three of them at the rate of 1 oz. per tree; the trees were mounded immediately after treatment. Counts of borers were made in the following June, and the results are shown in tables. The average numbers of living borers per tree in the orchard in which the greatest numbers of concentrations were tried were 0·25, 0·54, 0·95, 3·75 and 5·33 for 20, 15, 10, 5 and 2·5 per cent. ethylene-dichloride emulsions, 0·87 for paradichlorbenzene and 7·33 for no treatment. The results in the other orchards were of the same order, but the 10 per cent. emulsion was superior to paradichlorbenzene in one of them.

The value of ethylene dichloride in reducing infestation for more than one season was shown by annual examination of trees in an orchard that was treated with paradichlorbenzene in 1939 and with ethylene-dichloride emulsion in the next four years and in which blocks of trees treated with the rest of the orchard in one year were left untreated in the next. The average numbers of borers per tree in these blocks fell from 12 and 10·68 in the summers of 1940 and 1941, to 2·47, 2·42 and 1·26 in the next three summers, when they had been treated with ethylene dichloride two autumns before.

It is concluded that although the stronger concentrations of ethylene dichloride give the best control, the weaker ones may be the most satisfactory in practice, as the likelihood of injury and the cost of the treatment will be reduced by their use. In heavily infested orchards it may be advisable to use a 20 per cent. emulsion in the first year and lower concentration in the following year.

Ministry of Supply. **Some Properties and Applications of D.D.T.**—34 pp., 38 refs. London, H.M. Stationery Office, 1946. Price 6*d*.

The object of this publication is to summarise information on the practical applications of DDT. It contains a short account of the discovery of the compound and its insecticidal properties, and more detailed ones of its physical and chemical properties, the ways in which it is used in solution in organic solvents, in emulsions, suspensions, powders and aerosols, and as a constituent of paints and distempers, and methods and equipment for applying it.

Summaries are given of investigations on its toxicity to fish, experimental animals, domestic animals and man, which indicate that the danger from DDT is no greater than that from other insecticides such as lead arsenate and nicotine, and may be less, and to Arthropods, together with a brief discussion of its use against pests of crops and forests. Tables are appended showing some typical formulae for DDT insecticides and the results of field trials to determine the measure of control of various insects and other pests by it.

Cairaschi (E. A.). **Contribution à l'étude de *Lampronia quadripunctella* Steph. (*morosa* Zell.), Microlépidoptère nuisible au rosier.**—*Rev. Zool. agric.* **40** no. 5–6 pp. 33–38, 2 figs. Talence, 1941.

Climbing roses near Paris were severely infested in late March 1939 by overwintered larvae of *Incurvaria* (*Lampronia*) *quadripunctella*, F. (*morosa*, Zell.), which is not generally considered to be injurious. Its distribution in Europe is briefly reviewed and the larva, pupa and adult are described. The larvae feed in the buds of wild and cultivated roses, causing them to wither or dry up, and the plant assumes a bushy appearance, owing to the poor development of the young leaves and the stems of the leaflets. In most cases, there is only one larva in each bud, and after feeding for about ten days, it migrates to a neighbouring shoot, which it attacks at the base or, more generally, the tip, destroying the terminal bud. It pupates in a silken cocoon at the base of a leaf after 25–30 days. Adults emerged after ten days from pupae kept at a mean temperature of 16°C. [60·8°F.]. They first appeared in the field towards the end of May, but mating was not observed until 10th June. The eggs are deposited singly at the base of the leaves and hatch during the summer, but the larvae develop little before autumn, when they enter hibernation between the scale leaves of the buds. There is only one generation a year.

The damage is usually overcome by vigorously growing plants, but if necessary, the infestation can be controlled by an arsenical spray applied in early spring.

Tempere (G.). **Observations sur *Hypurus bertrandi* Perris, Coléoptère Curculionide nuisible au pourpier.**—*Rev. Zool. agric.* **42** (1943) no. 9–10 pp. 49–55, 10 refs. Talence, 1944.

Hypurus bertrandi, Perris, is of some economic importance in France since it feeds on purslane (*Portulaca oleracea*), which is sometimes used as a vegetable there. It was common near Bordeaux in 1943, and field and laboratory studies on its bionomics were begun at the end of July. The adults are known to overwinter in the bark of trees and similar situations. When purslane becomes available, they feed on the leaves and to a less extent on the stems and capsules. The egg, larval, prepupal and pupal stages last about four, nine, two and seven days in summer, and there are at least three overlapping generations a year. The eggs are deposited singly in small cavities in the parenchyma of the leaves, and the larvae mine the leaves and pupate in the soil. Infested leaves wilt and fall, and the larvae then migrate to fresh leaves ; if no fresh leaves are available the older larvae attack the superficial tissues of the stem. Although rather dry soil is preferred by this weevil, very dry conditions hinder both the entry of the larva into the soil and the emergence of the adults. Prompt destruction of infested plants appears to be the simplest and most effective method of control.

Vilcot (P.). **Note sur *Phyllobius oblongus*.**—*Rev. Zool. agric.* **42** (1943) no. 11–12 pp. 67–69, 1 fig. Talence, 1944.

Phyllobius oblongus, L., which was hitherto thought to be of little economic importance, caused considerable damage to 40-year-old pear trees in 1942 and 1943 at La Bohalle in north-western France. The adults appeared on the trees towards the beginning of April, fed on the buds, leaves and blossoms, so that hardly any fruit developed on some of the trees, and disappeared in June or July. A dormant tar-distillate spray and the routine spray of Bordeaux mixture containing 8 lb. calcium arsenate per 100 gals. applied against fungous disease and *Cydia pomonella*, L., had no effect on infestation by the weevil, in either year, but a spray of 8 lb. calcium arsenate in 60 gals. water, applied in 1943 on 24th April, two days after the routine spray, gave almost complete mortality. On neighbouring trees that received the routine spray only, infestation remained high until 30th April, when an application of calcium arsenate destroyed the weevils.

Feytaud (J.). **Sur deux ravageurs occasionnels des pâturages de montagne : la Psyché et le grillon.**—*Rev. Zool. agric.* **43** no. 1–2 pp. 1–12, 4 figs., 15 refs. Talence, 1944.

During the summer of 1943, *Areopsyche angustella*, H.-S. (*Psyche atra*, Esp.) and *Gryllus* (*Acheta*) *campestris*, L., caused appreciable damage to pastures in the Pyrenees and the former also on the Central Plateau of France [*cf. R.A.E.*, A **12** 390 ; **13** 150]. Notes are given on the life-histories and control of these insects, which are normally of little importance ; both are favoured by dry seasons, and both can be controlled by means of arsenical baits.

Pesson (P.). **Description du mâle de *Pulvinaria mesembryanthemi* Vallot et observations biologiques sur cette espèce (Hemipt. Coccidae).**—*Ann. Soc. ent. Fr.* **110** no. 1–2 pp. 71–77, 6 figs. Paris, 1941.

The adult male of *Pulvinaria mesembryanthemi*, Vallot, is described from examples reared from *Mesembryanthemum* in southern France. The immature males usually occurred together in large colonies on the leaves ; but single individuals were occasionally observed in female colonies. The author considers that each colony of males originates from one egg-mass, and that the crawlers fix themselves near the point at which they hatch. Since pairing was not observed in the laboratory, though female offspring, and in some cases males, were produced, and females examined just before or after they began to oviposit had empty spermathecae, he concludes that reproduction is parthenogenetic, most females producing only female progeny, but a few producing only males.

ANDRÉ (M.). **Sur le *Rhizoglyphus echinopus* Fumouze et Robin (Acariens).**—*Ann. Soc. ent. Fr.* **110** no. 1–2 pp. 83–103, 1 pl., 7 figs., 35 refs. Paris, 1941.

Descriptions are given of the hypopial nymph, the adult female and two forms of the adult male of *Rhizoglyphus echinopus*, Fum. & Rob., which was found in France on lily bulbs from Japan and on hyacinth bulbs of Dutch origin from Versailles in February 1936, and its bionomics, its geographical distribution, the damage that it causes and measures for its control are reviewed [*cf. R.A.E.*, A **17** 21; **33** 35].

CHAUVIN (R.). **Contribution à l'étude physiologique du criquet pèlerin et du déterminisme des phénomènes grégaires.**—*Ann. Soc. ent. Fr.* **110** no. 3 pp. 133–272, 29 figs., 8½ pp. refs. Paris, 1941.

In the first part of this paper, the author deals with the histology, physiology and anatomy of *Schistocerca gregaria*, Forsk. He describes the technique by which the gregarious and solitary phases of this locust, which he distinguishes by coloration and not by biometrical ratios, were reared in the laboratory in Paris [*cf. R.A.E.*, A **28** 550], and gives the results of investigations on the variation in colouring between the two phases. Ph. *solitaria* was bred from adults that were kept in isolation except at the actual time of mating, as pairs that were kept together longer gave rise to young of ph. *gregaria*. It was possible to mate females of ph. *solitaria* four or five times, but with each mating an increased proportion of the progeny belonged to the ph. *gregaria*, even when there was as much as 15 days between matings, owing to the cumulative effect of gregarious excitement. Two ways of obtaining mating with very short association were developed, and in the course of this work it was observed that one unfertilised female gave rise to 50 young of normal size, all of which were ph. *solitaria*.

A temperature of 40°C. [104°F.] was necessary for the hatching of eggs deposited by ph. *solitaria*, as compared with 28–30°C. [82·4–86°F.] by day and 20–25°C. [68–77°F.] by night for those of ph. *gregaria*. To obtain typical ph. *solitaria*, it was necessary to keep the hoppers in solitude from the time of hatching, in cages lined with green paper. Under these conditions, nearly 50 per cent. developed the pigmentation of ph. *solitaria* and the remainder more or less that of ph. *transiens dissocians*. Mortality during development was less in ph. *gregaria* (31–40 per cent.) than in phase *solitaria* (50–60 per cent.), and individuals of the former were much the more active and voracious and developed more rapidly; they weighed less and did not live so long as those of ph. *solitaria*. Females grew more rapidly than males, particularly of ph. *solitaria*, and an extra moult between the third and fourth occurred, frequently in this phase but seldom in the other. Growth was accelerated by grouping and retarded by isolation.

When ph. *gregaria* was bred for six or seven generations, the stock became enfeebled; growth slowed down, and dead locusts, which would have been devoured by a vigorous colony, were found in the cages. If rearing was carried further, outbreaks of disease occurred [*cf. loc. cit.*] and the stock died out. If, however, adults of ph. *solitaria* were grouped after the deposition of the first egg-pod, which gives rise to hoppers of ph. *solitaria*, they produced very vigorous offspring belonging to ph. *gregaria*, and these matured in less than a month. Grouping hoppers of ph. *solitaria* in the first instar caused them to acquire the characters of ph. *gregaria*, but this method of obtaining a fresh stock of the phase was less successful and appeared to give less robust individuals. When the hoppers of ph. *gregaria* obtained from the mating of grouped adults of ph. *solitaria* were isolated in the first instar, the gregarious impulse proved so strong that few if any developed the coloration of ph. *solitaria*, whereas small but increasing percentages of the young of successive generations of ph. *gregaria* developed the colouring of ph. *solitaria* when isolated. This increasing tendency of the offspring of successive gregarious generations to become ph. *solitaria* when isolated is used as a measure of the decrease of the gregarious impulse or residual gregariousness. When two hoppers of ph. *gregaria* were caged together in the first instar, they did not show gregarious colouring in the fifth instar if the cage was large enough, and did not both show perfect gregarious colouring however small the cage, whereas three nymphs caged together developed typical gregarious colouring. Hoppers of ph. *solitaria* that were fed on the excreta of ph. *gregaria* did not develop gregarious colouring. The results are also given of investigations on the pigmentation found on different parts of the body, the acridioxanthine content [*cf.* **33** 201], variations in respiration, excretion and tropisms and the effect of castration on the coloration of the gregarious male.

The second section deals with the effect of physical factors on the development of gregarious characters. It was found that high temperatures favoured their development and that weak illumination favoured the melanisation of ph. *gregaria* but had no effect on ph. *solitaria*.

Neither the colour of the light nor the relative humidity appeared to affect pigmentation. When the hoppers were reared in cages lined with paper of different colours, those of ph. *gregaria* showed practically no change in pigmentation, and those of ph. *solitaria* showed little, but ph. *transiens dissocians* reacted in colour to black, white, yellow and green. Gregarious colouring was present by the fifth instar when hoppers were grouped continuously or for one day out of four, but not when they were grouped after the third instar. Absolute isolation gave nearly 50 per cent. of examples showing solitary coloration in the fifth instar ; isolation from the third instar, and sometimes at the fifth, resulted in the coloration of ph. *transiens dissocians* in the fifth instar. Differences in age or sex in the members of a group did not prevent the development of gregarious colouring, which also resulted from grouping with other species of Acridids but not from grouping with Gryllids.

The author concludes that transformation to the gregarious phase is a reflex depending on contact with other living locusts or on visual perception of them [*cf.* **30** 105]. In addition to residual gregariousness, he distinguishes three other types. These are caused by visual or tactile (non-cumulative) stimulation of hoppers, the accumulation of carotene under the skin of gregarious male adults, due to excitement of the antennae, and the production of gregarious progeny by solitary females kept together with males.

The higher temperature required for the hatching of eggs of ph. *solitaria* may be the cause of the disappearance of swarms of locusts from areas that they have invaded. After a certain time, the numbers are reduced by natural enemies, and the locusts tend to transform to ph. *transiens dissocians* ; their descendants become increasingly solitary and require increasing heat for hatching until they reach a stage at which the prevailing temperature is too low, and they disappear completely. It is also possible that the scarcity of ph. *solitaria* in the permanent breeding grounds in Mauritania is due to the fact that only the eggs at the top of the egg tunnels receive enough heat to hatch them, owing to the depth at which they are laid. Furthermore, solitary adults are so rare in these areas that some females must remain unfertilised and some pair only once

KENNEDY (J. S.). **Observations on the Mass Migration of Desert Locust Hoppers.** —*Trans. R. ent. Soc. Lond.* **95** pt. 5 pp. 247–262, 1 fig., 17 refs. London, 1945.

The following is almost entirely the author's summary. Observations on marching bands of hoppers of *Schistocerca gregaria*, Forsk., such as have already been recorded in the literature [*cf. R.A.E.*, A **19** 733 ; **31** 522], were made in Persia in 1943 and Kenya Colony in 1944 with close attention to detail and some field experiments. It appears that optical responses of various types play a dominating rôle in the behaviour of migrant hoppers. Among these, compensation-reactions to fellow-hoppers are of first importance, endowing a marching band with a tendency to resist external deflecting influences. This tendency is designated as "gregarious inertia". Supplementing gregarious inertia in enabling a constant common direction to be maintained all day despite temporary interruptions, deviations or isolation of individuals is a light-compass-reaction to the sun. The important influence of various features of terrain on the route taken is largely visual. In relation to obstacles there is a tendency to follow the line of maximum mutual visibility as between members of a band, and a less important tendency to follow the line of maximum constancy of the visual field. The factors determining the choice of direction when marching starts, and those responsible for separate bands moving in parallel, remain incompletely known. The orientation of hoppers basking in the sun before marching starts is probably among them.

GNADINGER (C. B.). **Pyrethrum Flowers. Supplement to second Edition 1936–1945.**—9¼×6 ins., pp. xiv, 381–690, 40 figs., 1,373 refs. Minneapolis, Minn., McLaughlin Gormley King Co., 1945.

This supplement to the second edition of a work already noticed [*R.A.E.*, A **24** 564] incorporates the information in a previous supplement [**25** 167] and the considerable data on the production and insecticidal uses of pyrethrum that have accumulated since. The pagination is continuous with that of the second edition, the subject matter is arranged under the same chapter headings, and a complete index to both volumes is provided. The subjects dealt with at greatest length are the commercial sources of pyrethrum and biological methods for its evaluation ; other chapters deal with the possibilities of growing pyrethrum plants in the United States, the active principles, the evaluation of pyrethrum by chemical methods, the correlation of chemical assays and biological tests, the manufacture of pyrethrum insecticides, and the ways in which they are used.

PAPERS NOTICED BY TITLE ONLY.

WILKINSON (D. S.). **Description of Palearctic Species of *Apanteles* (Hymen., Braconidae).**—*Trans. R. ent. Soc. Lond.* **95** pt. 3 pp. 35–226, 153 figs., 8 pp. refs. London, 1945.

MUESEBECK (C.-F. W.). **Report of the Committee on Common Names** [including a list of 26 additional approved popular names of insects].—*J. econ. Ent.* **38** no. 4 p. 515. Menasha, Wis., 1945. [*Cf. R.A.E.*, A **30** 528.]

PORTER (C. E.). **Breve nota acerca de un Pentatómido predator.** [*Podisus* (*Apateticus*) *nigrolimbatus*, Spin., predacious on *Orgyia* (*Notolophus*) *antiqua*, L., in Chile.]—*Rev. chil. Hist. nat.* **45** (1941) pp. 10–11, 4 refs. Santiago, Chile, 1943. [*Cf. R.A.E.*, A **31** 206.]